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New York State Bridge and Tunnel Commission

AND

New Jersey Interstate Bridge and Tunnel Commission



Hudson River Vehicular Tunnel

CONTRACT NO. 4

TUNNELS BETWEEN A POINT ABOUT ONE THOUSAND FEET
WEST OF THE RIVER BULKHEAD NEAR THE LINE OF
TWELFTH STREET, JERSEY CITY, AND A POINT
ABOUT SIX HUNDRED FEET WEST OF
THE NEW YORK PIERHEAD LINE—
TWO LAND SHAFTS AND
TWO RIVER SHAFTS
NEW JERSEY—NEW YORK

INVITATION AND INFORMATION FOR CONTRACTORS, SPECIFI-
CATIONS, FORMS OF CONTRACT, BONDS AND
CONTRACTOR'S PROPOSAL

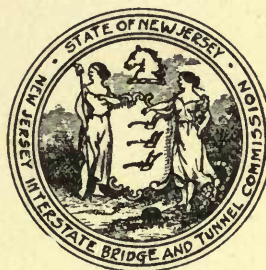
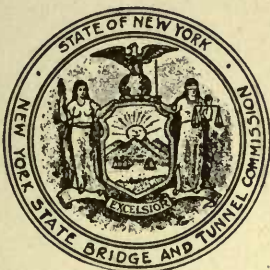
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COMMENCEMENT OF ADVERTISEMENT OF INVITATION
AND INFORMATION FOR CONTRACTORS

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New York State Bridge and Tunnel Commission

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New Jersey Interstate Bridge and Tunnel Commission



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NEW YORK STATE BRIDGE AND TUNNEL COMMISSION
and
NEW JERSEY INTERSTATE BRIDGE AND TUNNEL COMMISSION

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INVITATION AND INFORMATION FOR CONTRACTORS.

The New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission invite proposals to construct a portion of two (2) tunnels, two (2) land shafts and two (2) river shafts for a Vehicular Tunnel under the Hudson River.

The tunnels will begin about one thousand (1,000) feet west of the present bulkhead in the Erie Railroad yard, Jersey City, N. J., and extend in an easterly direction to within about six hundred (600) feet of the New York pierhead line. The land shafts will be located about one hundred forty (140) feet west of the present bulkhead in the above mentioned railroad yard and the river shafts will be located about one hundred (100) feet west of the New Jersey pierhead line as established in 1913.

The work under this contract will include the care and support of all surface, sub-surface and overhead structures, and their restoration if disturbed by tunneling operations. East of the pierhead line the tunnels will be built under a permit from the Secretary of War and the Contractor will be required to assume the obligations imposed by this permit relative to the work of tunnel construction.

Sites for the land and river shafts and for the Contractor's plant and waterfront facilities, as indicated on the contract drawings, will be furnished to the Contractor for his use.

Bidders must examine the form of contract and the specifications and the contract drawings, must visit the location of the work, inform themselves of the conditions

INFORMATION FOR CONTRACTORS.

along the line of the work, and must make their own estimates of the facilities and difficulties attending the execution of the work.

The contract requirements include provisions as to; an adequate plant, the use of compressed air, the prosecution of the work in a railroad terminal yard, the Contractor's responsibility for damage to property or injury to persons, the difficulties to be encountered in tunnel excavation, the methods required in erecting and bolting the tunnel lining and in sinking shafts near the bulkhead and pierhead lines, the requirements as to quality of materials and workmanship, the necessity of conducting the work by methods most conducive to safety and the importance of completing the work within the time prescribed.

A more detailed description of the work to be done and other requirements, provisions, details and specifications are given in the form of contract and specifications, copies of which may be purchased at the office of the Commissions, Room 617, Hall of Records, Borough of Manhattan, New York City.

Partial payments to the Contractor will be made, as the work proceeds, as provided in the contract. Such payments will include payments for plant to be made from time to time during the erection of the power plant and shields, the final payment for plant becoming due when it is ready for operation. The payments for plant will be deducted as the work proceeds from the amounts due the Contractor under the Schedule Items of the contract.

The Contractor will be required to begin actual work within sixty (60) days after the date of the delivery of the contract and must complete the work as soon as

INFORMATION FOR CONTRACTORS.

practicable and within a period of thirty-six (36) months after the date of the delivery of the contract.

Sealed bids or proposals will be received at the office of the Commissions, Room 617, Hall of Records, New York City, until the seventh day of February, 1922, at three (3:00) o'clock P. M., Eastern Standard Time, at which time or at a later date, to be fixed by the Commissions, the proposals will be publicly opened.

Proposals must be in the form prescribed by the Commissions and are invited in either or both of two forms. In Form "A" the bidder is to state his prices for the work proposed without dependence upon the award of any other contract. In Form "B" the bidder is to state his prices for the work proposed in case he should also be awarded Contract No. 3, which is the New York River Section of the Hudson River Vehicular Tunnel, advertised concurrently herewith. The proposal in Form "B" herein, in order to be valid, must be accompanied by a proposal in Form "B" for the construction of the said New York River Section under Contract No. 3.

A statement, based upon the estimate of the Chief Engineer of the Commissions, of the quantities of the various classes of the work and of the nature and extent, as near as practicable, of the work required, is to be found in the schedule forming a part of the Contractor's proposal. The quantities given in such schedule are approximate only, being given as a basis for the uniform comparison of bids, and no claim is to be made against the State of New York or the State of New Jersey for damages or anticipated profit or loss of profit on account of any excess or deficiency, absolute or relative, in the same. The Commissions reserve the right, as stated in the contract, to increase or to diminish or to omit entirely any of the quantities listed in the schedule.

INFORMATION FOR CONTRACTORS.

The unit prices must not be improperly balanced, and any bid which the Commissions consider detrimental to the States' interest may be rejected.

Every proposal must, when submitted, be enclosed in a sealed envelope endorsed "Proposal for Constructing the New Jersey River Section of the Hudson River Vehicular Tunnel" and must be delivered to the Commissions or their Secretaries, and in the presence of the person submitting the proposal it will be deposited in a sealed box in which all proposals will be deposited.

No proposal will be received or deposited unless accompanied by two certified checks, for one hundred fifty thousand dollars (\$150,000) each, one payable to the order of the "Comptroller of the State of New York" and the other payable to the order of the "Chairman of the New Jersey Interstate Bridge and Tunnel Commission," and drawn upon National or State Banks or Trust Companies satisfactory to the Commissions, and having their principal offices in New York City or in the Cities of Newark or Jersey City. SUCH CHECKS MUST NOT BE ENCLOSED IN THE ENVELOPE CONTAINING THE PROPOSAL. A receipt will be given for these checks. Unless forfeited under the conditions herein stipulated such checks will be returned to the bidders upon surrender of the receipts at the time herein provided.

No proposal will be considered unless the consent to become surety for the faithful performance of the contract, in case the same is awarded to the bidder, as contained in the Contractor's Proposal herein, is duly executed by two or more bonding or surety companies authorized to do business under the laws of the State of New York or the State of New Jersey or by two or more individuals. The corporations or individuals executing the consent must submit with

INFORMATION FOR CONTRACTORS.

the bid a detailed statement in affidavit form setting forth a list of their assets and liabilities. In order to be acceptable to the Commissions, the proposed sureties must show an excess of assets over liabilities in an amount equal to or greater than the proposed bond, which assets must consist either of improved real estate, first mortgages, bonds or stocks, approved by the Commissions. The sureties must further be ready and willing to transfer, mortgage, deposit or hypothecate any such assets as collateral security for the performance of the bond to be executed by them whenever requested to do so by the Commissions or either of them.

If the bidder makes proposals on both Contract No. 4 and Contract No. 3, the certified checks accompanying each bid and the sureties' consent must be complied with in connection with each proposal, and, in case the bidder is awarded both contracts, the bonds provided for in each contract must be executed.

No proposal, after it shall have been deposited with the Commissions, shall be withdrawn for any reason whatsoever.

The award of the contract will be made by the Commissions as soon as practicable after the acceptance of the bids and the contract will be awarded or all bids will be rejected within thirty (30) days after the opening of the bids, but the Commissions reserve the right to extend this time as in their opinion public interest may require.

The bidder whose proposal is accepted will be notified as to such acceptance and as to whether the sureties proposed are approved by the Commissions. Within five (5) days after such notification the bidder shall, in person or by duly authorized representative, attend at the said

INFORMATION FOR CONTRACTORS.

office of the Commissions, and such bidder shall then deliver a contract in the form herein provided, duly executed and with its execution duly proved.

If the sureties named in the proposal are not approved by the Commissions, the bidder naming such sureties will be required, within five (5) days after notice of such disapproval or within such further period, if any, as may be prescribed by the Commissions, to substitute other sureties approved by the Commissions. Within five (5) days after such approval, the bidder shall deliver the contract duly executed and approved in the manner stated above.

At the time of the delivery of the contract the Contractor will be required to furnish security to the State of New York by depositing a bond in the sum of one million dollars (\$1,000,000) and security to the State of New Jersey by depositing a bond in the sum of one million dollars (\$1,000,000). These bonds must be in the forms annexed to the contract.

Deposits made by bidders whose proposals are not accepted will be returned within three (3) days after the contract is executed and delivered and its provisions in respect to the bonds or deposits are complied with, unless all proposals shall be rejected, in which event such deposits will be returned within three (3) days after such rejection. The deposit of the successful bidder will be returned when the contract is executed and its provisions in respect to the bonds or deposit are complied with.

To assist the Commissions in determining who is the lowest responsible bidder, the Commissions or the Chief Engineer may require the Contractor to produce satisfactory evidence of his experience in the kind of work

INFORMATION FOR CONTRACTORS.

required under this contract and his ability to perform the same.

On the part of the State of New Jersey any waiver affecting the time of advertisement and length of time of opening bids, the amount of the certified check or bond or any provisions relating thereto, or the time of the award, will be determined by the New Jersey Commission, with the consent of the State House Commission, as in their opinion the public interest may require.

The provisions of the invitation and information for bidders are for the sole benefit of the Commissions and no right shall be deemed to accrue to any Contractor by reason of the submission of any bid hereunder, or by the waiver or non-enforcement of any provisions or requirement of the invitation.

The right to reject any and all bids is reserved.

ENABLING RESOLUTIONS.

CONTRACT.

The invitation and information for contractors hereto attached, the Contractor's bonds, the proposal submitted by the Contractor and the contract drawings herein described are hereby made a part of this contract. Other provisions of the contract follow in Chapters I to X, inclusive.

CHAPTER I.

PREMISE.

Agreement, made this day of
One thousand nine hundred twenty-two, between the
New York State Bridge and Tunnel Commission, acting
for and in behalf of the State of New York, AND the
New Jersey Interstate Bridge and Tunnel Commission,
acting for and in behalf of the State of New Jersey,
hereinafter called the "Commissions," parties of the first
part, and

hereinafter called the "Contractor," part* of the
second part:

ENABLING RESOLUTIONS.

WHEREAS, the Commissions are authorized by law by
the State of New York and the State of New Jersey, re-

*Here and in like blanks hereafter insert "y" or "ies" as the case may be.

ENABLING RESOLUTIONS.

spectively, to construct a tunnel or tunnels under the Hudson River, one-half of the cost of which shall be paid by each of the respective States; and

WHEREAS, there has been set aside out of the moneys made available by the State of New York for the use of the New York State Bridge and Tunnel Commission and available for the purpose of this contract, the sum of

dollars,
and the said Commission has certified to the New Jersey Interstate Bridge and Tunnel Commission as follows, to wit:

"The New York State Bridge and Tunnel Commission hereby certifies to the New Jersey Interstate Bridge and Tunnel Commission that it has available to the said New York Commission, for the purposes of the construction of a vehicular tunnel or tunnels under the Hudson River, the sum of

New York
Certificate.

dollars,
for the purpose of paying out of the said sum hereby set aside its share, to wit, one-half of a certain contract for the construction of a section of the proposed vehicular tunnel under the Hudson River to be made by this Commission and the New Jersey Interstate Bridge and Tunnel Commission, parties of the first part and

part of the second part, dated the day of
, 1922"; and

ENABLING RESOLUTIONS.

WHEREAS, there has been set aside out of the moneys made available by the State of New Jersey for the use of the New Jersey Interstate Bridge and Tunnel Commission and available for the purpose of this contract the sum of

dollars,

and the said Commission has certified to the New York State Bridge and Tunnel Commission as follows, to wit:

New Jersey
Certificate

"The New Jersey Interstate Bridge and Tunnel Commission hereby certifies to the New York State Bridge and Tunnel Commission that it has available to the said New Jersey Commission, for the purposes of the construction of a vehicular tunnel or tunnels under the Hudson River, the sum of

dollars,

for the purpose of paying out of the said sum hereby set aside its share, to wit, one-half of a certain contract for the construction of a section of the proposed vehicular tunnel under the Hudson River to be made by this Commission and the New York State Bridge and Tunnel Commission, parties of the first part and

part of the second part, dated the day of , 1922"; and

WHEREAS, the New York State Bridge and Tunnel Commission has adopted the following resolution:

New York
Resolution.

"RESOLVED, that the New York State Bridge and Tunnel Commission, acting for and in behalf of the State of New York, pursuant to the authority vested in it by law,

ENABLING RESOLUTIONS.

do enter into a contract jointly with the New Jersey Interstate Bridge and Tunnel Commission, acting for and in behalf of the State of New Jersey, as parties of the first part, with

part of the second part, for the construction of a section of the proposed vehicular tunnel under the Hudson River, which contract is to be dated the day of , 1922; and be it further

“RESOLVED, that this Commission shall pay as its share of the said contract one-half of the amount determined to be due thereunder; and be it further

Limitation of Liability.

“RESOLVED, that this contract is deemed by this Commission to be necessary for the construction of the said tunnel or tunnels and to be included in the cost of said construction; and be it further

“RESOLVED, that this Commission shall cause to be set aside out of the moneys available to this Commission for the construction of said tunnel or tunnels the sum of

dollars,
to meet its share of said contract;” and

WHEREAS, the New Jersey Interstate Bridge and Tunnel Commission has adopted the following resolution:

“RESOLVED, that the New Jersey Interstate Bridge and Tunnel Commission, acting for and in behalf of the State of New Jersey, pursuant to the authority vested in it by law, do enter into a contract jointly with the New York State Bridge and Tunnel Commission, acting for and in behalf of the State of New York, as parties of the first part, with

New Jersey Resolution.

ENABLING RESOLUTIONS.

part of the second part, for the construction of a section of the proposed vehicular tunnel under the Hudson River, which contract is to be dated the day of , 1922; and be it further

Limitation of
Liability.

“RESOLVED, that this Commission shall pay as its share of the said contract one-half of the amount determined to be due thereunder; and be it further

“RESOLVED, that this contract is deemed by this Commission to be necessary for the construction of the said tunnel or tunnels and to be included in the cost of said construction; and be it further

“RESOLVED, that the Treasurer of the State of New Jersey, as custodian of ‘The State Highway Extension Fund,’ set apart out of the said fund or out of the proceeds of the State Highway Extension Bonds the sum of

dollars (\$)

for the purposes of this contract;”

Now, Therefore, in consideration of the mutual covenants and agreements hereinafter contained, the parties hereto do hereby for themselves, their heirs, executors, administrators, successors and assigns agree with each other as follows:

This contract shall bind the State of New York and the New York State Bridge and Tunnel Commission for one-half only of the amount of money to be expended hereunder.

This contract shall likewise bind the State of New Jersey and the New Jersey Interstate Bridge and Tunnel Commission for the other one-half only of the amount of money to be expended hereunder.

This contract shall bind the respective States only to the extent of moneys available therefor, and no liability on account of this contract or obligation shall be incurred

GENERAL PROVISIONS AND DEFINITIONS.

hereby by the respective States or Commissions beyond the moneys available for the purposes specified therein.

The Contractor admits that he is familiar with the laws of the State of New York and of the State of New Jersey whereby the Commissions are authorized to construct a tunnel or tunnels under the Hudson River and that he is especially familiar with the authority, powers and limitations of authority and powers created or imposed by law upon the Commissions.

CHAPTER II.

GENERAL PROVISIONS AND DEFINITIONS.

ARTICLE I.—The Contractor agrees to construct the section of tunnel herein described, together with all the work necessary therefor or incidental thereto. The States agree to pay to the Contractor the sums of money hereinafter mentioned at the times and in the manner and upon the terms and conditions hereinafter set forth.

Outline of
contract.

ARTICLE II.—Titles, headings, running headlines and marginal notes are printed hereon merely for convenience and shall not be deemed to be any part of this contract for any purpose whatever.

Marginal
notes.

ARTICLE III.—The following words or groups of words used in this contract shall, unless the context clearly indicates another meaning is intended, be construed as follows:

Definitions.

(1) The word "States" to mean the State of New York and the State of New Jersey.

"States."

GENERAL PROVISIONS AND DEFINITIONS.

"Commissions." (2) The word "Commissions" to mean the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission or the lawful successors of either or both of them.*

"Contractor." (3) The word "Contractor" to mean the part of the second part to this contract and**

and any and every person or corporation who or which shall at any time be liable in the place of or for the part of the second part to perform any obligations under this contract assumed by the part of the second part. For convenience the Contractor is hereinafter referred to as if the Contractor were an individual. The word "he" shall, as the sense may require, include "she," "it" and "they"; the word "him" shall include "her," "it" and "them"; and the word "his" shall include "her," "its" and "their."

"Comptrollers." (4) The word "Comptrollers" to mean the Comptroller of the State of New York and the Comptroller of the State of New Jersey and the officers or board to whom or to which their powers may hereafter appertain.

"Engineer." (5) The word "Engineer" to mean the Chief Engineer of the Commissions or his duly authorized representative and any successor or successors duly appointed

*Whenever the term "States" or "Commissions" is used as referring to one of the contracting parties, the same shall be taken to mean the parties of the first part to this contract.

**Here insert, as the case may be, either "its successors," or "his executors," "administrators," or "their successors," or "their executors," "administrators."

GENERAL PROVISIONS AND DEFINITIONS.

or any deputy or substitute for him who shall be appointed by the Commissions or by their authority.

(6) The word "Tunnel" to mean that part of the Vehicular Tunnel which the Contractor herein agrees to build under this contract, together with all appurtenances thereto which are to be constructed or provided by the Contractor.

"Tunnel."

(7) The words "Vehicular Tunnel" to mean the whole work connected with the Vehicular Tunnel Project.

"Vehicular Tunnel."

(8) The word "notice" to mean a written notice.

"Notice."

(9) The words "directed," "required," "permitted," "ordered," "designated," "prescribed" or words of like import, used in the specifications or upon the drawings, to mean, respectively, the direction, requirement, permission, order, designation or prescription of the Engineer, and similarly the words "approved," "acceptable," "satisfactory," or words of like import, used in the specifications or upon the drawings, to mean, respectively, approved by, or acceptable or satisfactory to, the Engineer.

"Direction, etc."

(10) The word "Works" to mean all the matters and things herein agreed to be furnished or done by or on the part of the Contractor.

"Works."

(11) The word "ton" to mean the short ton of two thousand (2,000) pounds.

"Ton."

(12) The words "mean high water" to mean the datum plane of surveys as established by the Commis-

"Mean high water" and datum plane of levels.

GENERAL PROVISIONS AND DEFINITIONS.

sions, to which vertical distances are referred. "Mean high water" (M.H.W.), elevation 300.00, is two and six hundred fifty-three thousandths (2.653) feet above the "United States Coast and Geodetic Survey" datum, which is "mean sea level" at Sandy Hook, N. J. The figures given in the contract and specifications or upon the contract drawings after the word "elevation" or an abbreviation thereof refer to this "mean high water" datum.

"City." (13) The word "City" to mean Jersey City, New Jersey.

"Daily newspaper." (14) The words "daily newspaper" to mean any paper regularly published in New York City or Albany, N. Y., or in Jersey City, Newark or Trenton, N. J., on every day or every day except Sundays and holidays.

"Inspector." (15) The word "Inspector" to mean any representative of the Engineer designated by him to act as inspector.

"Tunnel lining." (16) The words "tunnel lining" to mean the cast-iron or cast-steel lining used in the tunnels or cross passage.

Contractor's address. ARTICLE IV.—The Contractor hereby designates room number on the floor of the building number in the City of New York, or room number on the floor of the building number in the City of , New Jersey, the latter city to be within the Metropolitan District of New York, as the place where all notices, directions and other communications may be served, mailed or delivered. The delivery at the aforesaid place or deposit in a postpaid wrapper directed to the aforesaid place, in any post office

GENERAL PROVISIONS AND DEFINITIONS.

box regularly maintained by the Post Office Department, of any notice, direction or other communication to the Contractor shall be deemed to be sufficient service thereof upon the Contractor as of the date of such delivery or deposit. The said address may be changed at any time by an instrument in writing executed and acknowledged by the Contractor and delivered to the Commissions. Service of any notice, direction or other communication may also be made upon the Contractor personally, or if the Contractor be a Corporation, upon any officer or director thereof.

ARTICLE V.—If the Contractor shall cause any part of this contract to be performed by a sub-contractor, the obligations to perform the work under the provisions of this contract shall apply to such sub-contractor and his officers, agents and employees in all respects as if he and they were employees of the Contractor; and the Contractor shall not in any manner thereby be discharged from his obligations and liabilities hereunder, but shall be liable hereunder for all acts and negligence of the sub-contractor, his officers, agents and employees as if they were employees of the Contractor. The employees of the sub-contractor shall be subject to the same provisions hereof as employees of the Contractor; and the work and material furnished by the sub-contractor shall be subject to the provisions hereof as if furnished directly by the Contractor.

Liability for
acts of sub-
contractor and
his employees.

ARTICLE VI.—The Commissions shall have as their representative on the Works, a Chief Engineer whose office, until further notice, will be Room 614, Hall of Records Building, Borough of Manhattan, New York

Substitute for
Chief Engineer.

GENERAL PROVISIONS AND DEFINITIONS.

City, who shall be the representative of the Commissions in directing the work of the Contractor and with whom the Contractor shall deal as the representative of the Commissions and any engineer substituted by the Commissions in place of the Chief Engineer during the absence, illness or disability of the Chief Engineer or when the Commissions shall so determine shall, during his official connection, have all the power and authority of the Chief Engineer and in all respects be recognized as such Chief Engineer.

Commissions
may disapprove
sub-contractor.

ARTICLE VII.—The Contractor, before making any sub-contract for the work, shall state in writing to the Engineer for approval, the name of the proposed sub-contractor, the portion of the work which such sub-contractor is to do or the materials which such sub-contractor is to furnish, the place of business of such sub-contractor and such other information as may be required.

Commissions
may become
parties to
sub-contracts
for cast-iron
tunnel lining.

The sub-contract or contracts for the cast-iron tunnel lining shall be approved by the Commissions before the same are executed. The Commissions shall, if they so elect, have the right at any time to be and become parties to the said sub-contracts for the purpose of giving and securing to the Commissions an irrevocable option to succeed to all of the right, title and interest of the Contractor in and to the sub-contract for cast-iron tunnel lining in the event of the default of the Contractor hereunder, or if the Commissions so elect, the Contractor shall assign, transfer and deposit with the Commissions, whenever required by them so to do, such contract or contracts, as additional collateral security for the faithful performance of the terms of this contract by him. If the Contractor shall default hereunder, the Commissions shall have the right and the option to assume all of the rights and obligations of the Contractor under any such contract or

GENERAL PROVISIONS AND DEFINITIONS.

contracts for cast-iron tunnel lining upon giving to the parties of the said contract five (5) days' notice of their intention so to do. The form of such sub-contracts shall contain provisions conferring the aforesaid option.

ARTICLE VIII.—The Contractor shall not assign, transfer, convey, sublet or otherwise dispose of this contract or of his right, title or interest therein or any part thereof or of his power to execute such contract to any other person, company or corporation without the previous consent in writing of the Commissions; and he shall not assign, whether by power of attorney or otherwise, any of the moneys to become due and payable under this contract unless by and with like consent. If the Contractor shall, without such previous written consent, assign, transfer, convey, sublet or otherwise dispose of this contract or of his right, title or interest therein or any part thereof or his power to execute this contract, or any of the moneys to become due and payable under this contract, to any other person, company or corporation, this contract may, at the option of the Commissions, be revoked and annulled and the States shall thereupon be relieved and discharged from any and all liability and obligations growing out of this contract to the Contractor and to the person, company or corporation to whom he shall assign, transfer, convey, sublet or otherwise dispose of the same, and the said Contractor and his assignee, transferee, or sub-lessee, shall forfeit and lose all moneys theretofore earned under this contract except so much as may be required to pay his employees; and no right under this contract or to any money to become due hereunder shall be asserted against the States, at law or in equity, by reason of any so-called assignment of this contract or any part thereof or of any moneys to grow due hereunder unless authorized as

Assignment of
contract
prohibited
except by per-
mission of
Commissions.

GENERAL PROVISIONS AND DEFINITIONS.

aforesaid by the written consent of the Commissions; provided that nothing herein contained shall be construed to hinder, prevent or affect an assignment by the Contractor for the benefit of his creditors made pursuant to the Statutes of the State of New York or the State of New Jersey.

Labor law and
workmen's
compensation.

ARTICLE IX.—The Contractor agrees to comply with the provisions of any laws of the State of New York and of the State of New Jersey relative to the compensation, hours of labor, conditions of employment of any laborer, workman, or mechanic employed by him, and especially Chapter 36 of the Laws of 1909, State of New York, and Chapter 95 of the Laws of 1911, State of New Jersey.

The Contractor agrees to abide by any rule or order of any board or official authorized or directed by law to enforce provisions of any law of the State of New York and the State of New Jersey relating to compensation, hours of labor, or conditions of employment of any laborer, workman, or mechanic employed by him hereunder.

Provisions
deemed
inserted.

ARTICLE X.—Each and every provision of law required to be inserted in this contract should be, is and is deemed to be inserted herein, and if, through mistake or otherwise, any such provision is not inserted or is not correctly inserted, then this contract shall forthwith, upon the application of either party, be amended by such insertion so as to comply strictly with the law without prejudice to the rights of either party hereunder.

Unlawful pro-
visions void.

ARTICLE XI.—If this contract contains any unlawful provision not an essential part of the general structure of the contract and which shall not appear to have been a controlling or very material inducement to the making

WORK TO BE DONE, PRICES, ETC.

thereof, the same shall be deemed of no effect and shall, upon the application of either party, be stricken from this contract without affecting the binding force of the contract as it shall remain after omitting such provision.

ARTICLE XIII.—No claim shall be made by the Contractor against any member, officer, agent or employee ~~of the Commissions personally, under or by reason of this contract or any matter arising therefrom or any of~~ this contract or any matter arising therefrom or any of its articles or provisions or of anything ordered or required hereunder.

Members or employees of Commissions not personally liable.

CHAPTER III.

WORK TO BE DONE, PRICES, ETC.

ARTICLE XIV.—The Contractor shall furnish all the labor and materials, plant, power, tools, equipment, supplies, and other means of construction necessary or proper for the excavation and construction of the Tunnel in the manner and within the time hereinafter specified. He shall complete the excavation and construction of the Tunnel and do all work and furnish all labor and materials in and about such excavation and such construction to the satisfaction of the Commissions and in accordance with the plans, contract and specifications and at the prices herein agreed upon and fixed therefor; provided, however, the contract drawings may from time to time be altered or modified as hereinafter provided. There are included within his obligation under this Article, as essential features thereof, the provision of air-compressing and other plant adequate in all respects to insure the simultaneous progress of the Tunnel according to the best rules and usages of such work; the employment of methods best adapted to avoid damage to adjacent buildings and other property; and the requirement that the structures when completed shall be water-tight.

Work to be done.

WORK TO BE DONE, PRICES, ETC.

Incidental work
included.

ARTICLE XV.—The work which is to be done under this contract includes the protection, support and maintenance, and when necessary the underpinning of adjacent and abutting buildings, bulkheads and piers; the protection, support and maintenance of railroad tracks and railroad structures, sewers, pipes, ducts, conduits, cables, poles, wires, vaults of buildings, retaining walls and all other surface, sub-surface and overhead structures with their connections and other appurtenances; the maintenance of traffic on streets, and other public places; and the performance of all such additional and incidental work as may be necessary for the completion of said Tunnel and the restoration, including where necessary the reconstruction, of all surface, sub-surface and overhead structures which may have been directly or indirectly affected, disturbed or injured by the Contractor to as useful, safe, desirable and good a condition as existed before construction was begun.

Payment to
Contractor.

ARTICLE XVI.—The States shall pay, and the Contractor will receive, in full compensation for the excavation and the construction of the Tunnel and for all expenses in connection therewith or incidental thereto, including the furnishing of all labor, materials, plants, power, tools, appliances, equipment and supplies, and for all loss and damage arising out of the nature of the work aforesaid or from the action of the elements or from any unforeseen obstruction, difficulty or delay encountered in the prosecution of the work and for all risks of any description connected with the work, and for all expenses incurred by or in consequence of the suspension or discontinuance of the work as herein specified, the prices contained in the Schedule of Unit Prices following, to wit:

SCHEDULE OF UNIT PRICES.

SCHEDULE ITEMS.

EXCAVATION.

- Item 1.—For earth excavation, both above and below mean high water (except tunnel excavation and shaft excavation), including excavation for pipes, ducts and conduits, the sum of
- dollars (\$)
- per cubic yard.
- Item 4.—For shaft excavation in earth, above mean high water, the sum of
- dollars (\$)
- per cubic yard.
- Item 5.—For shaft excavation in earth, below mean high water, the sum of
- dollars (\$)
- per cubic yard.
- Item 6.—For shaft excavation in rock, the sum of
- dollars (\$)
- per cubic yard.
- Item 8.—For tunnel excavation wholly in earth, the sum of
- dollars (\$)
- per cubic yard.
- Item 9.—For tunnel excavation partly in earth and partly in rock, the sum of
- dollars (\$)
- per cubic yard.
- Item 10.—For tunnel excavation wholly in rock, the sum of
- dollars (\$)
- per cubic yard.

SCHEDULE OF UNIT PRICES.

SHIELD JUNCTIONS.

Item 16.—For furnishing and erecting junction bulkheads and locks, the lump sum of

dollars (\$))

per bulkhead.

Item 17.—For removing and disposing of junction bulkheads and locks, the lump sum of

dollars (\$))

per bulkhead.

Item 18.—For dismantling and disposing of shields, the lump sum of

dollars (\$))

per shield.

CONCRETE AND MASONRY.

Item 27.—For concrete (except concrete placed in compressed air), as follows:

- (a) For concrete used in changing sub-surface structures and concrete not otherwise provided for, the sum of

dollars (\$))

per cubic yard.

- (b) For shaft concrete (except concrete protection outside the steel of the river shaft caissons), the sum of

dollars (\$))

per cubic yard.

- (c) For concrete protection outside the steel of the river shaft caissons, the sum of

dollars (\$))

per cubic yard.

SCHEDULE OF UNIT PRICES.

(d) For tunnel concrete, the sum of
dollars (\$))
per cubic yard.

Item 28.—For concrete placed in compressed air, as follows:

(b) For shaft concrete, the sum of
dollars (\$))
per cubic yard.

(d) For tunnel concrete, the sum of
dollars (\$))
per cubic yard.

Item 29.—For mortar batches used in connection with placing concrete, either in normal or compressed air, the sum of
dollars (\$))
per barrel of cement used.

Item 35.—For granite facing on the outside of the river shaft caissons, the sum of
dollars (\$))
per cubic yard.

Item 36.—For granite curbing in the tunnels, the sum of
dollars (\$))
per lineal foot.

GROUT.

Item 45.—For 1 to 1 Portland cement grout, not placed in compressed air, the sum of
dollars (\$))
per barrel of cement used.

SCHEDULE OF UNIT PRICES.

Item 46.—For 1 to 0 Portland cement grout (neat grout), not placed in compressed air, the sum of

dollars (\$)

per barrel of cement used.

Item 47.—For 1 to 1 Portland cement grout, placed in compressed air, the sum of

dollars (\$)

per barrel of cement used.

Item 48.—For 1 to 0 Portland cement grout (neat grout), placed in compressed air, the sum of

dollars (\$)

per barrel of cement used.

Item 49.—For 1 to 1 mixed cement grout placed in compressed air, as follows:

(a) For Portland cement used in mixed cement grout, the sum of

dollars (\$)

per barrel of Portland cement used.

(b) For natural cement used in mixed cement grout, the sum of

dollars (\$)

per barrel of natural cement used.

Item 50.—For 1 to 0 mixed cement grout (neat grout), placed in compressed air, as follows:

(a) For Portland cement used in mixed cement grout, the sum of

dollars (\$)

per barrel of Portland cement used.

(b) For natural cement used in mixed cement grout, the sum of

dollars (\$)

per barrel of natural cement used.

SCHEDULE OF UNIT PRICES.

PILING AND TIMBERING.

Item 54.—For reinforced concrete piles to support the river shaft caissons in final position, as follows:

(b) For twenty (20) inch piles, the sum of
dollars (\$))
per lineal foot.

(c) For twenty-four (24) inch piles, the sum of
dollars (\$))
per lineal foot.

Item 57.—For platform required to be left around the river shafts, the sum of

dollars (\$))
per square foot.

Item 59.—For timber bulkheads in the land shafts, the sum of

dollars (\$))
per thousand (1,000) feet, board measure.

WATERPROOFING.

Item 60.—For waterproofing, treated woven fabric (except dry ply), not laid in compressed air, without protective layer of brick, as follows:

(a) For one (1) ply, the sum of
dollars (\$))
per square yard.

(b) For two (2) ply, the sum of
dollars (\$))
per square yard.

SCHEDULE OF UNIT PRICES.

- (c) For three (3) ply, the sum of
dollars (\$))
per square yard.
- (d) For four (4) ply, the sum of
dollars (\$))
per square yard.
- (f) For six (6) ply, the sum of
dollars (\$))
per square yard.

Item 64.—For waterproofing, treated woven fabric, laid in compressed air, including protective layer of brick, as follows:

- (d) For four (4) ply, the sum of
dollars (\$))
per square yard.
- (f) For six (6) ply, the sum of
dollars (\$))
per square yard.

Item 66.—For applying (but not furnishing) protective waterproof coating, as follows:

- (a) On the outside steel of the river shaft caissons, and on the steel water-stops of the land shaft caissons, the sum of
dollars (\$))
per square yard.

STEEL AND WROUGHT IRON.

- Item 70.—For built-up steelwork (except steelwork of the land and river shaft caissons) and steelwork not otherwise provided for, the sum of
dollars (\$))
per ton.

SCHEDULE OF UNIT PRICES.

Item 71.—For steelwork forming part of the completed work of the land and river shaft caissons (except steel rods and bars), the sum of

dollars (\$))

per ton.

Item 72.—For steel beams and shapes, with or without connections (except steelwork of the land and river shaft caissons and special rolled floor beams for the tunnel roadway), the sum of

dollars (\$))

per ton.

Item 73.—For steel rods and bars for reinforcing concrete, the sum of

dollars (\$))

per ton.

Item 74.—For wire mesh, the sum of

dollars (\$))

per ton.

Item 75.—For special steel structures, as follows:

(a) For special rolled floor beams for the tunnel roadway, the sum of

dollars (\$))

per ton.

(b) For built-up floor beams for the tunnel roadway, the sum of

dollars (\$))

per ton.

SCHEDULE OF UNIT PRICES.

- (c) For steelwork in the connecting rings between the caissons and the tunnel lining, the sum of

dollars (\$))

per ton.

- (d) For steelwork in the permanent tie-rod anchorages, the sum of

dollars (\$))

per ton.

Item 76.—For high tensile steel, as follows:

- (a) For tunnel bolts and nuts, including soft steel or wrought-iron washers, the sum of

dollars (\$))

per ton.

- (b) For permanent tie-rods, including bolts, pins, turn-buckles and clevises (but not including anchorages), the sum of

dollars (\$))

per ton.

Item 77.—For copper steel, as follows:

- (a) For plates, bolts, nuts and washers, the sum of

dollars (\$))

per ton.

Item 83.—For furnishing and placing ladders, hand bars and miscellaneous wrought-iron fixtures (but not including pipe or pipe fittings), the sum of

dollars (\$))

per pound.

Item 84.—For furnishing and placing wrought-iron or steel pipe in the tunnel, as follows:

- (a) For one (1) inch pipe, the sum of

dollars (\$))

per lineal foot.

SCHEDULE OF UNIT PRICES.

- (b) For one and one-half ($1\frac{1}{2}$) inch pipe, the sum of

dollars (\$)

per lineal foot.

- (c) For two (2) inch pipe, the sum of

dollars (\$)

per lineal foot.

- (d) For two and one-half ($2\frac{1}{2}$) inch pipe, the sum of

dollars (\$)

per lineal foot.

- (e) For three (3) inch pipe, the sum of

dollars (\$)

per lineal foot.

- (f) For four (4) inch pipe, the sum of

dollars (\$)

per lineal foot.

Item 85.—For furnishing and placing galvanized iron electric conduits in the tunnel, as follows:

- (a) For three-quarter ($\frac{3}{4}$) inch conduits, the sum of

dollars (\$)

per lineal foot.

- (b) For one (1) inch conduits, the sum of

dollars (\$)

per lineal foot.

- (c) For one and one-quarter ($1\frac{1}{4}$) inch conduits, the sum of

dollars (\$)

per lineal foot.

SCHEDULE OF UNIT PRICES.

- (d) For one and one-half ($1\frac{1}{2}$) inch conduits, the sum of
dollars (\$))
per lineal foot.

- (f) For three (3) inch conduits, the sum of
dollars (\$))
per lineal foot.

Item 86.—For furnishing and placing miscellaneous galvanized iron fixtures, as follows:

- (a) For outlet boxes in the tunnel, the sum of
dollars (\$))
each.

- (b) For pull boxes (4" x 4" x 3") in the tunnel, the sum of
dollars (\$))
each.

- (c) For pull boxes (6" x 6" x 4") in the tunnel, the sum of
dollars (\$))
each.

- (d) For sheet metal air flues complete, including fittings, the sum of
dollars (\$))
each.

- (e) For curb guards, ladders, hand bars and miscellaneous fixtures, the sum of
dollars (\$))
per pound.

Item 88.—For cast steel, as follows:

- (a) For tunnel lining, except pile segments, the sum of
dollars (\$))
per ton.

SCHEDULE OF UNIT PRICES.

- (b) For pile segments, the sum of
dollars (\$))
per ton.

CAST IRON.

- Item 90.—For cast-iron tunnel lining, the sum of
dollars (\$))
per ton.

- Item 91.—For furnishing new cast-iron hub and spigot
pipe (straight pipe) required for sub-sur-
face changes, the sum of
dollars (\$))
per ton.

- Item 92.—For furnishing new cast-iron hub and spigot
pipe (special castings) required for sub-sur-
face changes, the sum of
dollars (\$))
per ton.

- Item 95.—For furnishing and placing miscellaneous cast-
iron fixtures, as follows:

- (a) For new manhole and catch basin fixtures, grat-
ings, drain covers and castings not other-
wise provided for (not including pipe or
pipe fittings), the sum of
dollars (\$))
per ton.

- Item 100.—For furnishing and placing cast-iron water
or other tunnel service pipe, as follows:

- (b) For six (6) inch pipe, the sum of
dollars (\$))
per lineal foot.
- (c) For eight (8) inch pipe, the sum of
dollars (\$))
per lineal foot.

SCHEDULE OF UNIT PRICES.

- (d) For ten (10) inch pipe, the sum of
dollars (\$))
per lineal foot.
- (e) For twelve (12) inch pipe, the sum of
dollars (\$))
per lineal foot.

NON-CORROSIVE METAL.

- Item 107.—For furnishing and placing non-corrosive
metal, the sum of
dollars (\$))
per pound.

BRONZE.

- Item 108.—For furnishing and placing bronze fixtures,
as follows:
- (a) For bolts, wedges and hinges, the sum of
dollars (\$))
per pound.

TUNNEL DUCTS.

- Item 110.—For tunnel ducts, as follows:
- (a) For single way ducts, the sum of
dollars (\$))
per duct foot.
- (b) For two (2) way ducts, the sum of
dollars (\$))
per duct foot.
- (c) For three (3) way ducts, the sum of
dollars (\$))
per duct foot.
- (d) For four (4) way ducts, the sum of
dollars (\$))
per duct foot.

SCHEDULE OF UNIT PRICES.

- (e) For six (6) way ducts, the sum of
dollars (\$))
per duct foot.

ASBESTOS MATERIALS.

Item 112.—For furnishing and placing asbestos materials and compounds, as follows:

- (a) For one-quarter ($\frac{1}{4}$) inch asbestos lumber, the sum of
dollars (\$))
per square foot.

SUB-SURFACE WATER PIPE CHANGES.

Item 120.—For changing cast-iron water pipe (but not furnishing new pipe required), as follows:

- (b) For six (6) inch pipe, the sum of
dollars (\$))
per lineal foot.
- (c) For eight (8) inch pipe, the sum of
dollars (\$))
per lineal foot.
- (d) For ten (10) inch pipe, the sum of
dollars (\$))
per lineal foot.
- (e) For twelve (12) inch pipe, the sum of
dollars (\$))
per lineal foot.

NEW SUB-SURFACE GAS PIPE AND WATER PIPE LINES.

Item 123.—For laying cast-iron water pipe where required (but not furnishing new pipe), as follows:

- (b) For six (6) inch pipe, the sum of
dollars (\$))
per lineal foot.

SCHEDULE OF UNIT PRICES.

(c) For eight (8) inch pipe, the sum of
dollars (\$))
per lineal foot.

(d) For ten (10) inch pipe, the sum of
dollars (\$))
per lineal foot.

Item 124.—For laying cast-iron gas pipe where required
(but not furnishing new pipe), as follows:

(a) For four (4) inch pipe, the sum of
dollars (\$))
per lineal foot.

ENGINEER'S FIELD OFFICE.

Item 148.—For building and equipping an Engineer's field
office, the lump sum of
dollars (\$)).

FENCING.

Item 155.—For building tight board fence, the sum of
dollars (\$))
per lineal foot of fence built.

Work not
susceptible of
classification.

Item 300. For any work or materials which shall be
required to be done or furnished in or about the Works
which it is elsewhere in this contract expressly provided
shall be paid for under this Item, or

For any work or materials which shall be required to
be done or furnished in or about or for the more perfect
performance of the Works which are not mentioned,
specified, or indicated, or otherwise provided for in this
contract and which, in the opinion of the Engineer, are

SCHEDULE OF UNIT PRICES.

not susceptible of classification under the foregoing Items of the Schedule.

The Contractor shall, if ordered in writing by the Engineer, do and perform such work and furnish such materials at and for the actual necessary net cost in money to the Contractor for labor, for insurance upon such labor under the Workmen's Compensation Law, and for materials incorporated in the work, and in addition thereto fifteen per centum (15%) of such net cost.

Work to be performed at net cost and in addition 15%.

No member, officer or employee of the Commissions has authority to order any work under this Item unless the order be in writing and countersigned by the Engineer.

The Contractor shall have no claim in excess of the above, such payment being in full compensation for the performance of such work and the furnishing of such materials and for all expense in connection therewith and incidental thereto as aforesaid, including the expense of plant, power, tools, supplies and other means of construction, administration, superintendence, and insurance, and for all the loss, damage, risks and expenses hereinbefore mentioned in the first paragraph of this Article.

No claim in excess.

The amount of insurance upon labor under the Workmen's Compensation Law shall be determined by the amount of wages actually and necessarily paid for such labor and the rate of insurance for such labor paid by the Contractor either in the New York State Insurance Fund or in any stock corporation or mutual association authorized to transact the business of workmen's compensation insurance in the State of New York or the State of New Jersey as may be required by law in either or both states. If the Contractor shall not have insured

Insurance upon labor.

SCHEDULE OF UNIT PRICES.

either in such State Insurance Fund or in any such stock corporation or mutual association, the rate allowed will be the rate determined by the Compensation Rating and Inspection Board of New Jersey or the New York State Insurance Fund, as the case may be.

No payment
under this
Item for work
susceptible of
classification
under other
Items.

Payment shall not be made under this Item for any such work or materials which are so required to be done or furnished in or about or for the more perfect performance of the Works and which are not mentioned, specified, or indicated, or otherwise provided for in this contract, so far as such work or materials may be, in the opinion of the Engineer, susceptible of classification under the other Items of the Schedule, which work or materials shall be paid for in part or in whole, as the case may be, at the unit prices given in such other Items of the Schedule.

Daily reports
required.

If any work or materials shall be required to be done or furnished under this Item, for cost plus fifteen per centum (15%), the Contractor shall, at the end of each day, furnish to the Engineer daily time slips showing the name and number of each workman employed on such work, the number of hours employed thereon, the character of work he is doing and the wages paid or to be paid to him, the rate and amount of workmen's insurance and also a daily memorandum of such materials furnished, showing the amount and character of such materials, from whom purchased and the amount paid or to be paid therefor. If required by the Engineer or the Com-

SCHEDULE OF UNIT PRICES.

missions, the Contractor shall produce any books, vouchers, records and memoranda showing the labor and materials actually paid for and the actual prices therefor. Such daily time slips and memoranda shall not, however, be binding upon the States, and if any question or dispute shall arise as to the correct cost of such labor or materials, the determination of the Engineer upon such question or dispute shall be final and conclusive.

Instead of the method above prescribed for paying for any such work or materials under this Item, the Engineer may, but only with the approval of the Commissions, agree with the Contractor upon reasonable unit prices or a reasonable lump sum price for such work and materials. Such additional unit prices or such lump sum price shall be included under this Item (Item 300) as a supplemental schedule.

Prices may be
fixed by
agreement.

QUANTITIES.

Quantities only
for purpose of
comparing
bids.

ARTICLE XVII.—The estimated quantities of the various classes of work to be done and materials to be furnished under this contract specified in the Contractor's proposal are only for the purpose of comparing, on a uniform basis, the bids offered for the Works; and neither the States nor the Commissions nor any member of the Commissions assume responsibility for even the approximate correctness of the said estimated quantities and the Contractor shall not make or have any claim for damages or for anticipated profit or for loss of profit or otherwise because of any difference between the quantities of the various classes of work actually done and the estimated quantities of the items stated in the Contractor's proposal or because of the entire omission thereof in such proposal.

Commissions
may amplify
drawings.

ARTICLE XVIII.—The Commissions shall have the right during the progress of the work to amplify the drawings, to add explanatory specifications and to furnish additional drawings.

Commissions
may change
location.

ARTICLE XIX.—The Commissions expressly reserve the right to change the location of the Tunnel in any way that they may deem necessary for the public interest, and to alter the drawings aforesaid in any part or altogether at any time during the progress of the work. Such changes or alterations shall not constitute grounds for any claim by the Contractor for payment or allowance for damages or extra service other than is provided for in the different classes of construction under the schedule items of this contract, and for a reasonable extension of the contract time.

INSPECTION.

ARTICLE XX.—The Contractor shall complete all work in accordance with the plans and specifications and according to the other provisions of this contract and within the time specified in this contract in the most workmanlike manner and with the highest regard for the safety of life and property and according to the directions given by the Engineer.

Contractor
bound to
complete in
best manner.

ARTICLE XXI.—All labor, materials, plant, tools, appliances, equipment and supplies necessary to complete all work covered by the specifications and provisions of this contract, shall be furnished by the Contractor and shall be of the best character, each of its kind.

Best machinery
to be used.

ARTICLE XXII.—The Commissions contemplate, and the Contractor approves, the most thorough and minute inspection at all times by the Commissions and their Engineer and by their representatives or subordinates of all work to be done and of all materials to be furnished under this contract and of the manufacture or preparation of such materials. It is the intention of the Commissions that their Engineer shall draw the attention of the Contractor to all defects in workmanship or materials or other errors or variations from the requirements of this contract, but no omission on the part of the Commissions or their Engineer or any of their representatives or subordinates to discover or point out such errors, variations or defects, shall give the Contractor any right or claim against the States or shall in any way relieve the Contractor from his obligations according to the terms of this contract.

Inspection.

INSPECTION.

Contractor to
afford facilities
for inspection.

ARTICLE XXIII.—The Contractor shall at all times give to the Commissions and their members, to the Engineer and his assistants and to any person designated by the Commissions all facilities, whether necessary or convenient, for inspecting the work to be done and materials to be furnished under this contract. The members of the Commissions, the Engineer and his assistants and all persons bearing the authorization of the Commissions shall be admitted at any time summarily and without delay to any part of the Works or to inspection of materials at any place.

Uncovering
finished work.

ARTICLE XXIV.—The Engineer shall be furnished by the Contractor with every reasonable facility for ascertaining whether the work is in accordance with the requirements and intention of this contract, even to the extent of uncovering or taking down portions of finished work. Should the work thus exposed or examined prove satisfactory, the uncovering or taking down and the replacing of the covering or the making good of the parts removed shall be paid for at the contract prices for the class of work done; but should the work exposed or examined prove unsatisfactory, such uncovering, taking down, replacing and making good shall be at the expense of the Contractor.

Inspection not
to relieve
Contractor.

ARTICLE XXV.—The inspection of the work shall not relieve the Contractor of any of his obligations to fulfill this contract as herein prescribed, and defective work shall be made good and unsuitable materials will be rejected even though such work and materials may have been previously accepted or estimated for payment. If the work or any part thereof shall be found defective before the final completion and acceptance of the Works,

ENGINEER TO DETERMINE.

the Contractor shall forthwith make good such defects in a manner satisfactory to the Engineer, and if any material selected or brought upon the ground for use in the work shall be condemned by the Engineer as unsuitable or not in conformity with the plans and specifications, the Contractor shall forthwith remove such materials.

ARTICLE XXVI.—No acceptance of any part of the Works or of materials therefor shall relieve the Contractor of his obligation to furnish sound material and perform sound work, whether with respect to such part or to any other part of the Works.

Acceptance not
to relieve
Contractor.

ARTICLE XXVII.—To prevent disputes and litigations, the Engineer shall in all cases determine the classification for payment and the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be performed or furnished under this contract, shall determine every question in relation to the Works and the performance thereof and every question which may arise relative to the fulfillment of this contract on the part of the Contractor. His determination and estimate shall be final and conclusive upon the Contractor, and if any question touching this contract shall arise between the parties hereto, such determination and estimate shall be a condition precedent to the right of the Contractor to receive any money under this contract.

Engineer's
determination.

ARTICLE XXVIII.—The Engineer shall make all necessary explanations as to the meaning and intention of the specifications, shall give all orders and directions contemplated therein or thereby and in every case in which a difficult or unforeseen condition shall arise in the performance of the work required by this contract.

Engineer's
explanation.

FACILITIES FOR OTHER CONTRACTORS.

Contractor to
obey directions
of Engineer.

The Contractor shall promptly obey and follow every direction which shall be given by the Engineer, including any direction which the Engineer shall give by way of withdrawal, modification or reversal of any previous direction given by him.

Facilities
for other
contractors.

During the progress of the work under this contract it will be necessary for other contractors and persons employed by the States to do work in or about the construction of the Tunnel, including but not limited to the laying of pavement, drawing cables, installing wires for lighting, applying certain finish to the tunnels, constructing air ducts and foundations for the ventilation house near the land shafts, and completing all air ducts and roadways at all shafts. The Commissions reserve the right to put such other contractors and persons to work and to afford them access to the site of the work to be performed hereunder at such time as the Commissions may in their discretion deem proper. The Contractor shall prosecute his work continuously and diligently and shall keep his work so advanced that the Commissions will be enabled to proceed with the above mentioned work, and any other work to be performed under other contracts. The Contractor shall so conduct his work as not to impede or interfere with the work of such other contractors or persons and shall so arrange his work that such other contractors and persons may expeditiously complete their work in order that the Vehicular Tunnel may be put into operation at the earliest possible date and for that purpose the Contractor herein shall afford to such other contractors or persons such facilities as the Engineer may require.

Engineer to
decide disputes.

Wherever any work performed or to be performed by the Contractor under this contract shall adjoin or affect any work performed or to be performed by any other

DRAWINGS.

contractor or contractors of the Commissions, including tunnel construction within one hundred (100) feet of the division lines between this contract and the contract for the New York River Section, or the work between this contract and any other contract, the Engineer shall decide any question or dispute between the Contractor and such other contractor or contractors and shall determine which of them shall perform or complete any work within the limits mentioned above and the manner, time and method in which they shall perform their respective work and the facilities which each shall afford to the other or others, and his determination shall as aforesaid be final and conclusive upon the Contractor.

ARTICLE XXIX.—The specifications do not include all requirements, but are requirements in addition to those elsewhere given or provided in this contract. The specifications and the other provisions of this contract and the contract drawings are intended to be explanatory of one another. Should, however, any discrepancy appear or any misunderstanding arise as to the import of anything contained in either, the explanation or decision of the Engineer shall be final and conclusive. In all drawings dimensions expressed by figures are to be used instead of scaled dimensions.

Specifications
and drawings
explanatory of
each other.

ARTICLE XXX.—The contract drawings referred to in this contract and in the specifications bear the general title:

Contract
drawings.

DRAWINGS.

NEW YORK STATE
BRIDGE AND TUNNEL COMMISSION

AND

NEW JERSEY INTERSTATE
BRIDGE AND TUNNEL COMMISSION

HUDSON RIVER VEHICULAR TUNNEL

CONTRACT NO. 4.

CONTRACT DRAWING NO.....

These drawings are numbered from 1 to 39, inclusive, dated December 9, 1921, and countersigned by the Chief Engineer.

Supplementary
drawings.

ARTICLE XXXI.—In addition to the contract drawings already mentioned, the Commissions have had prepared a set of drawings bearing the same general title as the contract drawings, but designated *Supplementary Drawings*. These supplementary drawings exhibit certain information which the Commissions have received from their Engineer of the general nature of the soil underlying portions of the work, the material through which the tunnels will pass, the nature and position of piers, bulkheads, surface railroads, water mains, gas and other pipes, sewers, electric subways, manholes, hydrants, catch basins and other surface, sub-surface and overhead structures.

Supplementary
drawings not
guaranteed.

ARTICLE XXXII.—These supplementary drawings are furnished to the Contractor without any guarantee on the part of the Commissions as to their completeness or correctness. If in the prosecution of the work difficulties

DRAWINGS.

of any nature be encountered which are not indicated or suggested by the supplementary drawings, or if additional surface, sub-surface or overhead structures or obstructions be found of different size or in different positions or of different nature from those shown on the supplementary drawings or if in any other way such supplementary drawings be found erroneous, incomplete or misleading, the Contractor shall take every necessary or proper precaution to overcome the unforeseen difficulty and to properly construct the Tunnel under such conditions and shall protect, support, maintain, shift, relay, reconstruct or rebuild the additional or different surface, sub-surface or overhead structures as required.

In addition to the supplementary drawings referred to above, samples of material taken in connection with test borings may be seen in the office of the Engineer; but as in the case of the supplementary drawings, there is no guarantee on the part of the Commissions as to their completeness or correctness.

Borings not
guaranteed.

ARTICLE XXXIII.—The Contractor hereby represents that prior to the execution of this contract, he has examined in detail on the ground the location of the work mentioned herein and indicated on the contract drawings and that he has fully examined the contract drawings and has read each and every clause and section of this contract and of the specifications and has had full opportunity to consider the same and make necessary investigations relating thereto; and he shall not make any claim for or have any right to damages or an extension of time for completion of the Works or any other concession because of any misinterpretation or misunderstanding of this contract or of the specifications or of the drawings or because of any lack of information.

Contractor has
examined loca-
tion, drawings,
etc.

SPECIFICATIONS—BRIEF DESCRIPTION OF THE WORK.

CHAPTER IV.

SPECIFICATIONS.

1. The general clauses of the specifications are grouped under different subdivisions and the requirements as to specific kinds of work under different items.

BRIEF DESCRIPTION OF THE WORK.

Location of
work.

2. The work to be done under this contract consists of constructing two (2) tunnels beginning about one thousand (1,000) feet west of the present bulkhead in the Eric Railroad Yard, Jersey City, and extending in an easterly direction to within about six hundred (600) feet of the New York pierhead line where the tunnels will join two (2) similar tunnels to be constructed from the New York side of the river. The work also includes the construction of two (2) land shafts west of the New Jersey bulkhead and two (2) river shafts connected by a cross passage near the New Jersey pierhead line, and building an Engineer's field office.

Form of
structure.

3. The tunnel structure is to be of cast iron or cast steel, lined with concrete, the land shaft structures will consist of reinforced concrete walls with steel bulkheads and roofs, and the river shaft structures will consist of steel walls filled with concrete.

Methods of
construction.

4. The tunnels are to be built under compressed air by the shield method similar to that heretofore employed for similar works and are to be driven without disturbance of the surface wherever over-lying structures might be affected. The shaft caissons are to be sunk by the compressed air method and in such a manner that full control of the structures will be assured at all times.

SPECIFICATIONS—METHOD OF PROSECUTING THE WORK.

5. The work to be done under this contract includes the performance of certain incidental work which is generally referred to in Article XV.

Incidental
work included.

GENERAL CLAUSES.

SUBDIVISION 1—METHOD OF PROSECUTING THE WORK.

6. All the work shall be prosecuted in the manner, according to conditions, best calculated to promote rapidity in construction, to secure safety to life and property and to reduce to a minimum any interference with train operation in the railroad yard, public travel and navigation. Decking of streets, paving and other surface work affecting, or affected by, street traffic shall be prosecuted during such hours as will reduce such interference to a minimum. Night work shall be conducted, in accordance with the direction of the Engineer, so that annoyance to occupants of abutting property shall be reduced to a minimum. The Contractor shall comply with reasonable requirements of the Erie Railroad Company relative to the conduct of his work, such as fencing, lighting, protecting property and making railroad operations safe in the adjacent terminal yard.

Manner of
prosecution.

7. The work in compressed air shall be carried on with full forces both day and night without intermission, except that the Contractor shall not be required to prosecute his work on Sundays or legal holidays unless to meet an emergency.

Work in compressed air
both day and
night.

8. In case of emergencies involving danger to life or property, or where the integrity of the work requires a continuous operation, work with an increased force may be ordered by the Engineer for such time as may be necessary.

Work to be
continuous in
emergencies.

SPECIFICATIONS—METHOD OF PROSECUTING THE WORK.

Work to be diligent in all parts.

9. The Contractor shall conduct his operations diligently in all parts of the work, co-ordinating the different parts so that the completion of each part as well as the entire work shall not be unnecessarily delayed and so that there shall be no interference or delay to other contractors of the Vehicular Tunnel project. Work is to be commenced and maintained under the orders and directions and to the full satisfaction of the Engineer.

Commissions may order working shifts increased.

10. The Tunnel built under this contract forms a part of the Hudson River Vehicular Tunnel, which the interests of the States imperatively require shall be completed and put into operation without delay. The Contractor shall prosecute his work in such manner as to make it reasonably probable, in the judgment of the Engineer, that the work will be completed within the time limited. The Contractor, if directed by the Commissions, shall rearrange the work and increase the number of shifts and the number of men in each shift to the extent that may be necessary to insure the completion of the work within the time required by this contract.

Contractor's plant.

11. The Contractor shall furnish plant and other means of construction adequate for the prosecution of the work at a rate of progress which, in the judgment of the Engineer, will secure the completion of the work within the time herein limited therefor. If at any time the plant or any portion of it shall appear to the Engineer to be or likely to become inadequate, incomplete or faulty, the Contractor shall promptly obey the orders of the Engineer to supplement or to remove and replace the same; but the failure of the Engineer to issue such orders shall not relieve the Contractor of his responsibility for the adequacy and safe operation of the plant.

SPECIFICATIONS—COMMENCING WORK.

12. No work shall be begun until the Commissions shall issue to the Contractor an order directing him to proceed. The order shall be in such form and shall cover such portions of the work as the Commissions shall prescribe.

Order to
begin work.

Permits for excavation will be issued to the Contractor but no permit will be issued until the Contractor has given satisfactory assurances that the materials for construction will be available when needed. Before any opening is made in a street or on private property a copy of the permit issued by the Commissions shall have been filed with the proper authorities, not less than five (5) days, unless the Engineer shall expressly direct work to begin within a shorter period.

Permits to start
excavation.

13. The Contractor, at least one (1) week before commencing work at any point, shall give notice in writing to the Engineer of his intention to commence such work, and if required by the Engineer shall submit plans for approval showing the methods contemplated in carrying out this particular work. The Contractor shall also, at least one (1) week before commencing or resuming manufacture of any article called for by these specifications, give notice in writing to the Engineer of his intention to commence or resume such manufacture, with the name and address of the manufacturer and the amount and description of the material to be manufactured.

Notice of in-
tention to com-
mence work.

14. Detailed drawings showing the location and construction of dumping or working platforms, gantries, passage ways, buildings and all other structures in connection with the Contractor's plant shall be submitted to the Engineer and must receive his approval before permits will be granted for their construction.

Plant struc-
tures to be
approved.

SPECIFICATIONS—LAWS AND ORDINANCES.

Compliance
with laws and
ordinances.

15. In all operations connected with the Works the Contractor shall strictly comply with all ordinances of Jersey City and of the Board of Health and all laws of the State of New Jersey and of the State of New York which are applicable to, and control or limit in any way the actions of those engaged in the work or affect the materials entering into the work, or affect the methods and appliances used by the Contractor in carrying out the work, and he shall further strictly comply with all other Federal, State and Municipal regulations applicable to the work, including the transportation of materials in and around the City and the Harbor of New York.

Permit of
Secretary of
War.

The Contractor shall strictly comply with the provisions of the permit issued by the Secretary of War for the construction of the Tunnel, which permit is printed as an appendix to the specifications and is made a part of this contract. The obligations imposed by the Secretary of War upon the Commissions in regard to the prosecution of this work, shall be assumed and carried out by the Contractor. These will include furnishing a bond sufficient to cover the entire cost of the removal of the temporary clay blanket outside the pierhead line and the restoration of the channel at the completion of the work of excavation. All expense of Government inspection as required by the Secretary of War shall be borne by the Contractor.

The above obligations on the part of the Contractor are subject to one exception, namely: the maintenance of a 1,000 foot channel, as provided for under Section 16 of the above mentioned permit. The Commissions will bear the expense in connection with the maintenance of this channel, except for the removal of such blanket as may be placed by the Contractor or except rectifying such changes in the river bed as the Contractor's operations may cause.

SPECIFICATIONS—PERMITS, WORKING DRAWINGS.

16. Whenever the construction of the tunnels or any other work pertaining thereto shall interfere with, disturb or endanger any sewer, water pipe, gas pipe, railroad, or other duly authorized surface, sub-surface or overhead structure, the work of construction at such points shall be conducted in accordance with the reasonable requirements of the owners or of the proper City authorities having care of and jurisdiction or control over such structures so interfered with, disturbed or endangered. All necessary permits from such owners or authorities for doing work at such places shall be obtained by the Contractor, and all charges, directly or indirectly connected therewith, shall be borne by him.

Requirements
of local
authorities.

Necessary
permits.

17. The Engineer will prepare and furnish to the Contractor during the progress of the work drawings in amplification or modification of the contract drawings and drawings showing the adjustment and reconstruction of all surface, sub-surface and overhead structures wherever the reconstruction of the same is necessitated by the construction of the Tunnel. The Contractor shall promptly, upon the delivery of this contract, furnish a written statement to the Engineer showing the order in which he desires the drawings to facilitate the prosecution of his work and this order will be followed so far as reasonably practicable and necessary. The first of these drawings will be given to the Contractor within thirty (30) days after this statement is received and the remainder from time to time, as may be reasonably and necessarily required by the Contractor, except that detail drawings for changes in sub-surface structures shall be furnished within a reasonable time after such structures are uncovered. The Contractor may, but only with the written consent of the Engineer, make changes in said written statement furnished to the Engineer showing the order

Drawings.

SPECIFICATIONS—PERMITS, WORKING DRAWINGS.

in which the Contractor desires the drawings, but the Contractor will be responsible for any delay resulting from any such changes and no extension of time or other allowance or concession will be made to the Contractor on account of any such change or any delay resulting therefrom. Where, however, changes are deemed necessary, they may be ordered under Article XVIII of this contract by the Engineer, who shall issue such drawings as may be necessary.

Working or
shop drawings.

The Contractor shall make all working or shop drawings which may be required in addition to the contract drawings or in addition to such other drawings as the Engineer may issue in amplification or modification of the contract drawings. All working or shop drawings shall be submitted in duplicate to the Engineer for his approval, which approval will be indicated by his countersigning one set of such working or shop drawings and returning the same to the Contractor. Should the working or shop drawings be not approved by the Engineer, then the Engineer will return one set of such working or shop drawings, with the necessary corrections and changes indicated thereon; the Contractor shall make such corrections and changes and again submit drawings in duplicate for the approval of the Engineer; and no work called for by said working or shop drawings shall be done until the approval of the Engineer shall be obtained, which approval will be given or refused within twenty (20) working days after delivery to him at his office of such drawings in duplicate. The Engineer's approval shall not relieve the Contractor of any responsibility for errors that occur in such drawings. Immediately upon final approval of such working or shop drawings by the Engineer, the Contractor shall furnish the Commissions with five (5) additional copies of such approved drawings. The tracings of all the approved working or shop draw-

SPECIFICATIONS—ORDERS AND DIRECTIONS TO CONTRACTOR.

ings made by the Contractor shall be delivered to and become the property of the Commissions prior to or upon the completion of the particular work covered by these drawings.

18. Orders and directions may be given orally by the Engineer to, and shall be received and promptly obeyed by, the Contractor or his representative or any superintendent, overseer or foreman of the Contractor who may have charge of the particular work in relation to which the orders or directions are given, and a confirmation in writing of such orders or directions will be given to the Contractor by the Engineer if so requested. The Contractor or his duly authorized representative shall be present at all times on the work to receive orders and directions from the Engineer. The Contractor shall also maintain, during the performance of the work an office in Jersey City in the vicinity of the shafts, at which he or his duly authorized representative shall be present at all times. Orders or directions, written or oral, from the Engineer delivered at said office shall be considered as delivered to the Contractor. Copies of the contract, including the specifications, and of the drawings for the work shall be kept at said office ready for use at any time.

Orders to
superintendent,
overseer or
foreman.

19. The Contractor must not allow waste material of any kind to remain on the streets or on the roadway to the shafts or to accumulate on the work, but he must cart away all waste material and dispose of it as hereinafter provided at his own expense. The Contractor shall also at his own expense keep the work, streets, private property and all public places occupied by him clear of all refuse and rubbish and leave them in a neat condition; but this is not to be construed as placing upon the Contractor the usual duties of the Street Cleaning Department.

Waste material.

SPECIFICATIONS—SANITARY MEASURES, TEMPORARY STRUCTURES.

Water supply.

20. The Contractor shall, at his own cost, provide for the water supply necessary for the work and he shall bear the cost of any connection, inspection, meter or other charge resulting therefrom.

Sanitary conveniences.

21. Sanitary conveniences, properly secluded from public observation, and of a form approved by the Engineer and to the satisfaction of the sanitary authorities, shall be constructed and maintained by the Contractor at his own expense, for the use of his employees.

Fences to be provided around work.

22. The Contractor, at his own expense, shall provide a neat substantial fence, approved by the Engineer, around his plant and around all openings and wherever else required for the protection of the work or the public. This does not in any way refer to the fence provided for in Section 155-1.

Gateways, openings, etc. to be guarded.

Gateways of such size and construction as approved by the Engineer, shall be placed at the openings for the Erie Railroad track passing through the land shafts plant site. Any openings temporarily unfenced and surface obstructions shall be guarded and shall be indicated at night by suitable and sufficient lights.

Temporary structures to be painted.

All temporary structures and fences erected by the Contractor shall be neat in appearance and shall be painted as directed by the Engineer.

Advertisements not permitted.

The Contractor shall not place or permit the placing of any advertising matter, other than the name and address of the Contractor, upon fences, buildings or any part of the work or plant or materials.

Competent men.

23. The Contractor shall employ competent, skillful and faithful men to do the work, and for special work requiring skill along any particular line, men especially skilled in this line shall be employed. Whenever the

SPECIFICATIONS—LIGHTING, FACILITIES FOR SURVEYS.

Engineer shall notify the Contractor in writing that in his opinion any man on the work is incompetent, unfaithful or disorderly, such man shall be discharged from the work and shall not again be employed on it.

24. Electricity shall be used for all lighting purposes and a sufficient number of lights shall be provided for the proper illumination of all parts of the work. The lighting of each tunnel shall be equivalent at least to that given by sixty-four (64) candle power lamps at intervals of thirty (30) feet. Adequate special illumination shall be provided wherever work is in progress or is to be inspected. Electric wires must be kept thoroughly insulated, and special precaution must be taken to avoid short circuits. Wherever electric power is used the power circuit shall be kept separate from the lighting circuit.

Electric
lighting.

25. The Engineer will give all lines and grades and will indicate the same by marks or points established at such intervals or in such manner as he deems necessary for the proper performance of the work. Such points and marks shall be carefully preserved by the Contractor.

Lines and
grades.

26. The Contractor shall keep the Engineer informed, a reasonable time in advance, of the time and places at which he intends to do work, in order that lines and grades may be furnished with the minimum of inconvenience to the Engineer and delay to the Contractor.

Request for
lines and
grades.

27. To facilitate the transfer of lines and grades, the Contractor shall, without charge to the States, suspend hoisting and all work that will in any way interfere with the surveys at such times and for such periods of time as the Engineer may deem necessary.

Suspension of
hoisting.

SPECIFICATIONS—FACILITIES FOR SURVEYS, ADDITIONAL BORINGS.

Payment for
facilities for
Engineer.

28. The Contractor shall furnish all work and materials called for by the Engineer for placing monuments, plugs, stakes, instrument platforms or other points or facilities used in surveys and all special lights or groups of lights that the Engineer may require in connection with surveys and payment therefor will be made in the manner provided in Schedule Item 300; but if any such point or facility be disturbed the Engineer may require the Contractor to replace it without compensation. The Contractor shall provide, without cost to the States, all the electric current the Engineer may require in connection with surveys.

Survey locks.

Locks for the transfer of survey lines into the tunnels shall be provided in the bulkheads east of the land shafts, if required by the Engineer. These locks shall be at least six (6) feet in diameter and provided with doors at each end. The furnishing of the materials for such locks will be paid for in the manner provided in Schedule Item 300, but all expense of erecting, placing and connecting such locks with the bulkheads shall be borne by the Contractor. On the completion of the tunnels and removal of the bulkheads these locks will become the property of the Contractor.

Additional
borings.

29. If the Engineer shall deem it necessary or advisable to make wash-borings or core-borings or both to supplement the borings already made or to drive test piles to obtain further information as to the character, extent and bearing power of the materials to be encountered in the construction of the Vehicular Tunnel, the Contractor shall make such borings or drive such piles in the manner, at the location and to the depths directed by the Engineer, and payment therefor will be made in the manner provided in Schedule Item 300.

Payment for compliance with the requirements of this Subdivision, except as otherwise herein specifically pro-

SPECIFICATIONS—ROADWAY TO SHAFTS.

vided, is deemed to be included in the unit prices stipulated in the Schedule.

SUBDIVISION 2—ROADWAY TO SHAFTS AND MAINTENANCE OF TRAFFIC.

30. Parcels 34, 21 and B, as shown on Contract Drawing No. 39, are provided as a means of access to the waterfront and the shaft sites. These parcels will be cleared by the Commissions of surface structures, except the track leading to sidings on 12th Street, poles carrying wires or cables, and fire hydrants. The Contractor shall furnish such protection to remaining and adjacent structures as is called for in Section 55, grade this area sufficiently for a roadway, plank the same at track crossings, change the locations of such poles as may be necessary and maintain the road in a safe and passable condition throughout the term of this contract. Beside maintaining a roadway to the above mentioned parcels, the Contractor shall perform such of the above mentioned work as may be necessary to make the roadway passable in 12th Street between Barnum Street and Provost Street. The above provisions are subject to the following exception:

Preparing
and maintain-
ing roadway.

Beginning sixty (60) days after the date of the delivery of the contract for the approach section, the Contractor of that section shall maintain the roadway from the easterly limit of the said section (North Tunnel) to Provost Street.

31. This roadway shall be fenced as provided in Section 155-1, and such lighting system installed as the Engineer may require, payment for which equipment will be made in the manner provided in Schedule Item 300. This roadway, the fence, and the lighting system shall

Fencing,
lighting, and
guarding
roadway.

SPECIFICATIONS—ROADWAY TO SHAFTS.

be turned over to the Commissions in good condition at the termination of this contract. The Contractor shall keep this roadway well lighted and shall provide watchmen at track crossings or other points to make it safe at all times. No separate payment will be made for the requirements of Sections 30 and 31, except such payment as are specifically provided for therein, but payment therefor is deemed to be included in the unit prices stipulated in the Schedule.

Pipe lines.

32. Within the limits of this roadway, the Contractor will be required to lay pipe lines leading to the shaft sites, including the water and gas lines from some suitable connection with the Jersey City mains to the land shaft site, as provided in Section 123-1.

Signs.

33. No lettering or signs shall be painted or posted on the roadway fence without the permission of the Engineer.

Facilities for
other contractors.

34. The Contractor is to afford to any other contractor, who may be awarded a contract for doing work in connection with the construction of the Vehicular Tunnel, adequate and sufficient rights of passage and re-passage over the roadway. In the event of a dispute between the Contractor herein and any other contractor or contractors having the right to use the roadway, the Engineer shall be the sole and final arbiter in the determination of the rights of the respective contractors to use the said right of way and the extent to which each of them shall be entitled to use the said right of way and the time and manner thereof.

SPECIFICATIONS—OCCUPATION OF STREETS.

36. Wherever excavations are decked or where gas might accumulate, suitable openings shall be provided for ventilation.

Openings for ventilation.

37. A reasonable amount of structural and other materials may be stored in the streets occupied by or adjacent to the work, but only to the extent that may be absolutely necessary to avoid delay in construction. Such materials shall not be allowed to accumulate but shall be replenished from day to day as they may be required. In any case, materials may be stored only with the permission of the Engineer, which permission shall be revocable at any time; and the Contractor, if so ordered, shall immediately remove such materials.

Storage of materials in streets.

If the exigencies of the work require the occupancy of any street for a longer period of time than provided in the previous paragraph, such occupancy will be allowed only upon the written permission of the Engineer, which permission shall be revocable at any time, and the Contractor, if so ordered, shall immediately, upon receipt of the order or within a period of time to be therein stated, remove such materials.

39. The Contractor shall not interfere with free access to any fire hydrant or fire alarm box, and shall place no materials within ten (10) feet of the same at any time. When materials are unavoidably placed or piled in the vicinity of a fire hydrant or fire alarm box and to such a height as to prevent it from being readily seen, the position of such hydrant or box shall be indicated by suitable signals, both day and night. When required, hydrants shall be extended by suitable tube or piping to an accessible point as approved by the Engineer and to the satisfaction of the Fire Department.

Access to fire hydrants.

SPECIFICATIONS—ACCESS TO BUILDINGS, RAILROADS, ETC.

Access to
buildings.

40. The Contractor shall not deprive any building or abutting property of means of access except with the consent of the occupant and after due notice to the Engineer. When access to any building or abutting property is temporarily cut off by the Contractor, he shall at his own cost handle any materials to be taken to or removed from such building or property, including materials to be removed by the Street Cleaning Department, between such building or property and the nearest accessible point on the street.

Access to
street cars.

The Contractor shall provide proper and easy means of access to surface street cars.

Decking,
how laid.

41. All decking and bridging and all timbers for the support thereof shall be sound, substantial and free from any defects that might impair their strength. The decking of roadways shall be of such thickness, and shall be so laid and supported, as to prevent deflection of adjacent planks separately when loaded. The planking of the top or wearing surface shall be hard yellow pine, unless otherwise permitted, shall be straight and free from shakes, shall be sized to a uniform thickness and shall be laid with tight joints.

42. Payment for compliance with the requirements of this Subdivision, except as otherwise herein specifically provided, is deemed to be included in the unit prices stipulated in the Schedule.

SPECIFICATIONS—UNDERPINNING.

SUBDIVISION 3—SUPPORT AND RESTORATION OF
BUILDINGS AND STRUCTURES.

44. The Contractor shall make use of such methods of work as are best adapted to preserve the safety and stability of foundations, bulkheads, walls or other parts of buildings and structures and to prevent any disturbance or damage thereto and he shall make good any damage which may in the course of construction be done to any such foundations, bulkheads, walls or other parts of buildings or structures.

Prevention
of damage.

45. The Contractor will be permitted to underpin, support or secure at his own expense such buildings, railroad tracks or other structures as he may deem it advantageous to himself in the prosecution of his work to so underpin, support or secure.

Underpinning.

All methods of underpinning, securing, supporting, protecting or maintaining buildings, bulkheads, piers, railroad tracks or other structures or of providing permanent foundations therefor shall be in accordance with drawings prepared by the Contractor and approved by the Engineer; but the approval by the Engineer of such drawings or methods shall not relieve the Contractor of responsibility for damages to persons and property as herein elsewhere provided.

46. The Contractor shall, at his own expense, make with the owners or tenants of buildings or other structures, or other persons, all arrangements which may be necessary for the underpinning, securing, supporting and repair or restoration of buildings or other structures.

Agreements for
underpinning
or supporting
structures.

SPECIFICATIONS—MAINTENANCE OF STRUCTURES.

Buildings to be
kept tenantable.

47. During the progress of the work, the Contractor shall make such temporary or permanent repairs or restoration as may be required to keep all buildings, parts of buildings, or other structures, disturbed or damaged by his operations, in a serviceable condition at all times, and he shall take such other measures as may be necessary for the protection of persons or property in or about the same.

Repairs to be
made promptly.

48. As soon as the work adjacent to any building or structure disturbed or damaged by the Contractor's operations is unlikely, in the opinion of the Engineer, to cause any further disturbance or damage, the Contractor shall promptly repair and make good all damage to such building or structure for which he is responsible as herein elsewhere provided.

Annoyance to
occupants to
be avoided.

49. When the Contractor has entered upon any premises for the purpose of underpinning, securing, supporting, repairing or restoring the same, he shall conduct the work with all possible despatch and in such manner that the annoyance to the occupants shall be as little as is practicable.

Commissions
may make
repairs.

50. If at any time the Engineer shall certify to the Commissions that the Contractor is unnecessarily or unreasonably delaying the work of repair or restoration of any building or structure disturbed or damaged by his work or is neglecting to provide proper protection for persons or property in or about such building or structure, the Commissions may make such repairs or cause the same to be made or provide such protection or cause the same to be provided and charge the expense of such work to the Contractor and may in addition to all other

SPECIFICATIONS—REPAIRS TO BUILDINGS.

remedies deduct such expense from any moneys then due or thereafter coming due to the Contractor under this contract.

51. Payment for underpinning, supporting or securing buildings, bulkheads, or other structures, their walls and other supports, porches, vaults, areaways and other parts of structures and all expense in connection therewith or incidental thereto, is deemed to be included in the unit prices stipulated in the Schedule for excavation.

Underpinning
not paid for.

52. Payment for repairing or restoring buildings, bulkheads or other structures disturbed or damaged by the Contractor's operations, or in any way incident thereto, and all expense in connection therewith or incidental thereto, is deemed to be included in the unit prices stipulated in the Schedule for excavation.

Expense of
repairing
buildings.

SUBDIVISION 4—MAINTENANCE AND CHANGES OF PIPES, RAILROADS, ETC.

53. Notice shall be given by the Contractor to the Erie Railroad Company, to all individuals, companies and proper City officials owning or having charge of surface, sub-surface or overhead structures along any part of the work, of his intention to commence operations on such part of the work, at least one (1) week in advance of such commencement, and the Contractor shall file with the Engineer at the same time a copy of such notice.

Notice to
owners, etc., of
structures.

54. All work of protecting, maintaining, moving, changing or restoring surface, sub-surface or overhead structures or appurtenances, shall be conducted in accordance with the reasonable requirements, and to the reason-

Requirements
of owners, etc.,
of structures.

SPECIFICATIONS—MAINTENANCE AND CHANGES OF STRUCTURES.

able satisfaction of the companies or City officials owning or having charge of the same, and the Contractor shall furnish such companies or City officials with all necessary facilities for inspecting the methods of caring for their structures.

Maintenance
and support of
structures.

55. The Contractor shall, at all times, by suitable means, protect from injury, maintain and support in an entirely safe condition for their usual service all sewers, pipes, ducts, conduits, poles, wires, cables, railroads, railroad structures, vaults, including vaults of buildings, docks, bulkheads, retaining walls and all other surface, sub-surface and overhead structures with their connections and other appurtenances, encountered in or affected by his work. Attention is particularly called to the proximity of the tunnels to the eight (8) foot sewer and the Western Union Telegraph Company's creosoted wood conduits located on the north side of the Erie Railroad yard in Twelfth Street produced.

Temporary
changes for
maintenance.

56. If such protection or the maintenance for such usual service makes it necessary, the Contractor shall temporarily shift, relay or reconstruct any such surface, sub-surface or overhead structure or appurtenance, and if required shall fully restore the same prior to the completion of this contract.

Temporary
changes for
Contractor's
convenience.

57. If the Contractor shall, for his own convenience in executing his work, temporarily shift, relay or reconstruct any such structure or appurtenance, he shall fully restore the same prior to the completion of this contract, but no such shifting, relaying or reconstructing shall be done without the previous consent of the Engineer.

SPECIFICATIONS—MAINTENANCE OF STRUCTURES AND SERVICE
IN PIPES.

58. If it is found that any such structure or any connection or other appurtenance of such structure in its original position would physically interfere with the Tunnel, the Contractor shall permanently shift, relay or reconstruct such structure or appurtenance to the extent required by the Engineer and according to his directions.

Changes to
avoid inter-
ference with
the Tunnel.

59. If any injury should occur to any such structure or appurtenance resulting from the Contractor's operations or in any way incidental thereto, he shall promptly and fully repair or restore such structure or appurtenance to as good a condition as existed before the injury was done and shall leave the same in a condition as useful, safe, durable and good as that which existed before his work began.

Repairs of
injuries.

61. The Contractor shall make all necessary arrangements for the shutting off and restoring the flow in water and gas pipes and their connections, and shall bear all necessary expense in connection with the same. In case it becomes necessary to shut off or interfere with the normal and continuous flow of water in any main, or with the connection to any hydrant, the Contractor shall give notice thereof at least forty-eight (48) hours in advance of such shutting off or interference to the proper authorities. In case it becomes necessary to shut off the water supply to any building, due notice shall be given in advance to the owners or tenants thereof. Copies of all such notices, shall be sent to the Engineer at the time of their issuance. The Contractor shall, if so ordered, make a temporary by-pass or other arrangement to preserve the flow of water while breaking connections.

Shutting off
and restoring
flow in water
and gas pipes.

SPECIFICATIONS—SAFETY OF STRUCTURES TO BE PRESERVED.

Location of
gates to be
ascertained.

62. Before excavating below any water or gas main in service, the Contractor shall ascertain the locations of all gates or valves in such main within the line of his work or adjacent thereto. A diagram showing such locations in exact relation to street and curb lines shall be kept posted in the Contractor's office on the work, for reference in case of emergency.

Access to
gates, valves
and manholes.

63. The Contractor shall provide convenient access to gates and valves on water and gas mains and to electric and other manholes, by means of trapdoors or other approved methods.

Cast-iron
pipes to be
preserved.

64. Wherever cast-iron pipe is changed, the Contractor shall use care in removing, and shall preserve all old pipe that is in good condition, so that it may be used in relaying and so as to avoid as far as possible the necessity of providing new pipe.

Support of
railroads.

65. Wherever excavations are made either from the surface or by tunneling under or adjacent to any railroad, the Contractor shall employ such methods as may be necessary to preserve the safety of such railroad and maintain the tracks in a serviceable condition to the reasonable requirements of the Railroad Company.

Changes of
structures.

66. If it is found that any abutting property or structure would physically interfere with the Tunnel or any work appurtenant thereto, the Contractor shall permanently change or reconstruct such structure to the extent required by the Engineer and according to his directions.

Plans of
structures to be
shifted.

67. The Engineer will prepare from time to time, as may be necessary, tentative drawings showing the pro-

SPECIFICATIONS--EXPENSE OF MAINTENANCE AND RESTORATION
OF STRUCTURES.

posed rearrangement of surface, sub-surface and overhead structures to be shifted, relaid or restored, and will submit the same to the parties interested. If any reasonable changes are requested by any of the said parties within ten (10) days after the submission of any tentative drawing, such changes will be made, if in the judgment of the Engineer they will best conserve the interests of all parties concerned. A further drawing will then be made which, on the approval of the Engineer, will be final.

68. As soon as the progress of the work permits, the Contractor shall restore all surface, sub-surface and overhead structures or appurtenances which have been changed on account of the tunnel work or in any way affected thereby, to a condition as useful, safe, durable and good as that which existed before his work began.

Restoration
of structures.

69. Payment for protecting, supporting, maintaining, shifting, relaying, reconstructing and restoring surface, sub-surface and overhead structures and other appurtenances and all expense in connection therewith or incidental thereto, except as otherwise herein specifically provided, is deemed to be included in the unit prices stipulated in the Schedule for excavation.

Expense of
maintenance
and changes
of structures.

71. Payment for maintaining and supporting, including reconstructing where necessary, all surface railroads with their appurtenances, and all expense in connection therewith or incidental thereto, is deemed to be included in the unit prices stipulated in the Schedule for excavation.

Expense of
maintaining
and supporting
railroads.

SPECIFICATIONS—EXCAVATION.

Facilities to be
given owners
to make
extensions.

72. If the owners or the City should desire to make any addition, alteration or extension to their structures or to do any work to or in connection with surface, sub-surface or overhead structures owned by them, the Contractor, by written permission, shall give said owners or the City all reasonable opportunity to perform such work; provided such work or alteration for the benefit solely of the owners of such structures does not cause the Contractor any serious loss or delay, as shall be determined by the Engineer.

SUBDIVISION 5—EXCAVATION.

Excavation,
how made.

73. Excavation for the tunnels will be made by the shield method. The shafts are to be excavated by sinking caissons under compressed air.

Excavation
includes
removal of all
materials.

74. Excavation will include the removal of earth, rock, boulders, pavements, masonry, piles, timbers and all other materials that it is necessary to remove in order to construct the Tunnel.

Earth defined.

75. Earth, referring to materials of excavation as classified for payment, shall mean all materials encountered except ledge rock in place.

Rock defined.

76. Rock, referring to materials of excavation as classified for payment, shall mean ledge rock in place. Boulders, detached portions of ledge rock, masonry and pavements will not be classified for payment as rock.

Drilling and
blasting.

77. Drilling and blasting shall be conducted carefully and in such a manner as to avoid as far as possible

SPECIFICATIONS—EXCAVATION: BLASTING.

loosening or shattering the rock beyond the ordered net lines of excavation. The Contractor shall blast to the extent directed and with explosives of such power and in such quantities and positions as will not make the excavation unduly large. All loose or shattered rock shall be removed. Where the rock exhibits a tendency to slip, slide or break large, the Contractor may be required to place the drill holes at close intervals on the outer lines of excavation.

The Contractor shall provide at his own expense such magazine houses for the storage of explosives in such localities and in such manner as may be approved by the proper municipal authorities in charge of such matters.

Magazines
for storage
of explosives.

78. Special care shall be taken in the use of explosives under or adjacent to buildings, piers, bulkheads or other surface, sub-surface or overhead structures. When any foundation or sub-surface structure is encountered in or alongside any excavation, the Contractor may be required to remove all material within five (5) feet of the same by means other than blasting. Wherever an electric current is used in discharging a blast the wires used shall be so insulated, placed and fastened at such a distance from any light or power line that there is no possibility of a short circuit in the blasting wires.

Blasting
adjacent to
buildings.

79. All City, State and other governmental regulations, together with such regulations as the Engineer may require, regarding the composition, transportation, storage and use of explosives shall be strictly complied with. The composition of explosives shall be such as to cause the least amount of injurious fumes. The quantity kept on hand shall not exceed the amount that is neces-

Use of
explosives.

SPECIFICATIONS—EXCAVATION: SHEETING, PUMPING, ETC.

sary to avoid delay to the work. Only experienced men shall be allowed to handle explosives. The Contractor may be required to observe special regulations regarding the time of blasting.

Sheeting,
bracing, etc.

80. All timber and lumber used for sheeting, shoring, bracing, roof timbering, decking or similar purposes shall be sound and free from any defects that might impair its strength and of sufficient dimensions for the purposes intended. All timber and lumber for purposes of the work defined by this contract shall be put in place by skilled workmen, shall be keyed tight by wedges where necessary and shall be so arranged as to be removed if required without disturbing the sides of the excavation. Steel sheeting, if used, shall be of a type approved by the Engineer.

Excavations to
be kept dry.

81. The Contractor shall keep all parts of the excavation sufficiently free from water to enable work to be done as nearly as possible in the dry. All water removed from the tunnels shall be conveyed to a suitable point of discharge, in covered flumes, or pipes, if required. It shall be allowed to settle in a tank or sump before being discharged into any sewer. The Contractor shall be responsible for any costs incurred in removing from sewers deposits caused by his work.

Pumping.

82. Wherever water is removed from an excavation by pumping in sandy or permeable material, the water shall first be drained to a central sump so arranged that the material in or around the excavation will not be disturbed by the pumping; well points or other special devices may be required, the rate of flow from each well being made so slow as not to remove the finest particles of material.

Well points.

SPECIFICATIONS—EXCAVATION: DISPOSAL.

84. All cars, carts, buckets and other vehicles used by the Contractor for the removal of material shall be tight and so arranged and so loaded as not to spill. Whenever a cart, bucket or other vehicle so used is leaky or unsuitable, it shall be immediately withdrawn from the work on notification by the Engineer.

Carts, etc.,
to be tight.

85. Excavated and waste material shall be removed expeditiously and disposed of in any place selected by the Contractor subject to the ordinances and regulations of the City authorities governing the disposal of such material and the regulations of the United States Government as to the disposal or dumping of material in and about or near the Harbor of New York.

Disposal of
excavated
material.

86. If at any time during the course of construction the States shall desire for their purposes or for the purpose of any political subdivision which they include, any part of the material excavated and the cost of such disposal shall not exceed the cost to the Contractor of the method in which he is then disposing of it, the Commissions may order such material dumped or turned over to the States, or any political subdivision which they include, at points designated by the Commissions without cost to the States. Anything encountered in connection with the excavation, such as relics or any other valuable material shall be considered the property of the Commissions and shall be disposed of as directed by the Engineer.

Excavated
material may be
taken by States.

Payment for compliance with the requirements of this Subdivision, except as otherwise herein specifically provided, is deemed to be included in the unit prices stipulated in the Schedule for excavation.

SPECIFICATIONS—COMPRESSED AIR REQUIREMENTS.

SUBDIVISION 6—COMPRESSED AIR REQUIREMENTS.

Work in compressed air. 87. All work in the tunnels before they are made water-tight and in the shafts before they are sealed and while the shields are being started is to be conducted in compressed air.

Plant to be adequate. 88. The Contractor shall, as provided in Section 11, furnish an adequate plant, including air-compressing, hydraulic and electrical machinery, hoists, pumps and all other necessary apparatus, all parts of which shall be of the highest grade in use for the work to be performed. The capacity of the plant shall be sufficient to meet not only usual conditions, but emergencies, and to afford at all times a sufficient margin for repairs.

Power for plant. The Contractor may use either steam or electricity for operating compressors and other machinery. In case steam power is used provision must be made for storing in tanks at each boiler-house enough feed water for twelve (12) hours' supply, unless connection can be made with two independent and separately sufficient sources of supply. If electricity is used for operating compressors supplying air to the Tunnel, at least two (2) supply cables shall lead directly from two (2) independent power stations, each cable being sufficient to supply power for the entire plant. Also, a third auxiliary cable shall be installed from a substation as a reserve to temporarily replace either one of the direct cables in case one of the latter should fail.

Location of air-compressing plant. 89. The Contractor shall not place or maintain any plant to generate steam for operating machinery nor any machinery to be operated by steam nor any air-compressing machinery, except such plant and machinery for temporary use as the Engineer may in writing permit under such restrictions as he shall impose, in any loca-

SPECIFICATIONS—COMPRESSED AIR REQUIREMENTS.

tion other than that provided for the purpose and shown on Contract Drawing No. 39. Special devices shall be installed in the plant to prevent smoke, cinders and dust. Every effort shall be made to minimize noise in connection with the operation of this plant.

90. The air-compressing plant shall be capable of furnishing simultaneously to each heading an air supply sufficient in volume and pressure to enable work to be done, as nearly as practicable in the dry, and to afford the degree of ventilation hereinafter specified, including to each shield heading an air supply at a pressure of fifty (50) pounds per square inch above atmospheric pressure equal to at least fifteen thousand (15,000) cubic feet of free air per minute for each river heading and at least ten thousand (10,000) cubic feet of free air per minute for each land heading as measured by piston displacement at a piston speed for any machine not exceeding the speed corresponding in the opinion of the Engineer to the safe continuous working capacity of such machine. In addition, the plant shall be capable of furnishing at all points of the work, including compressed air chambers, a sufficient air supply at a net pressure of one hundred (100) pounds per square inch, or at higher pressures if required, for operating drills, grouting machines and other appliances requiring high pressure air. The air for the compressors shall be drawn from pure outside sources, the inlets being at least twenty (20) feet above the surface of the ground, and care must be taken to keep the air from being fouled by smoke, lubricating oil or other impurities.

Capacity of air-compressing plant.

SPECIFICATIONS—COMPRESSED AIR: FIRE PRECAUTIONS,
RECORDS, ETC.

Records of
plant operation.

91. The Contractor shall keep a continuous record of the operation of each compressor, including the output, and the pressures supplied by the hydraulic machinery for the movements of each shield and shall furnish the Engineer each day a copy thereof. The revolutions of steam-driven compressors, if used, shall be registered by revolution counters. The pressures in each tunnel heading and in the caissons shall be registered continuously. Tests of the air compressors or other portions of the plant shall be made and additional records of plant operation kept as directed by the Engineer to determine the net output of the plant and the actual distribution to each caisson or heading.

Air to be
cooled.

92. Suitable and sufficient cooling apparatus shall be used to keep the temperature of the air supplied to the tunnels and caissons moderate at all times.

Precautions
against fire.

93. The buildings enclosing the air-compressing plant shall be fire-proof, and all the Contractor's buildings in the immediate vicinity of the shafts and the power plant shall be as nearly as practicable fire-proof. All reasonable precautions shall be taken against fire and provisions shall be made for the extinction thereof, including the extinction of fire in the electrical equipment.

In each tunnel, a water line, available for use at all times, shall extend from the shaft into the heading, with hose connections every two hundred (200) feet. A length of fifty (50) feet of hose, with nozzle and connection, shall be placed on each side of each bulkhead and in the immediate vicinity of each shield and kept always ready for use. The utmost precautions shall be observed at all times in regard to fire in compressed air. Smoking in compressed air shall not be permitted.

SPECIFICATIONS—QUARTERS AND MEDICAL FACILITIES FOR
WORKMEN.

94. The quarters for the workmen shall be well lighted and heated and plentifully provided with running hot and cold water, showers, toilets, lockers and facilities for resting, for drying clothing and for providing the men with hot coffee.

Workmen's
quarters.

95. The Contractor shall retain the services of one or more acceptable and qualified physicians who shall have had satisfactory experience in the treatment of the physiological effects of compressed air and who shall care for the health of the employees and supply treatment and medicines to them whenever needed. A physician shall be on duty on the work in person at all times when compressed air work is being done.

Medical and
surgical
attendance.

96. The Contractor's physician and medical staff shall give first aid treatment to the employees of the Commissions whenever required. No separate payment will be made for such service, but payment therefor is deemed to be included in the various unit prices stipulated in the Schedule.

First aid
treatment for
Commissions'
employees.

97. The Contractor shall maintain in close proximity to the shafts a completely equipped hospital room with an attendant constantly in charge while compressed air work is in progress. Each hospital room shall include in its equipment an approved hospital lock with two compartments, where men can be subjected to the working pressure if attacked by caisson disease. Such locks shall contain cots, a telephone, a clock, an air gauge and arrangements for ventilating and heating, and shall be kept in a thoroughly sanitary condition. The Contractor shall have standing arrangements for the immediate re-

Hospital rooms
and locks.

SPECIFICATIONS—COMPRESSED AIR: SCIENTIFIC INVESTIGATION,
MEDICAL EXAMINATION.

moval and hospital treatment of any employee who may be injured or who may become ill.

Facilities
for scientific
investigation.

98. The Contractor shall afford the Commissions all reasonable facilities for the investigation of the physiological effects of compressed air, including the conduct of experiments and the collection of records in connection therewith, to be undertaken by such scientific body or individuals as may be designated for the purpose by the Commissions. The Contractor shall furnish daily statements to the Engineer of the number of decompressions, the number of cases of the "bends" among his employees, and in case of serious illness he shall immediately furnish to the Engineer a statement of such illness.

Accidents.

In case of accidents either within or without the compressed air chamber the Contractor shall immediately furnish to the Engineer full data relative to such accidents.

Medical
examination.

99. The Contractor shall employ no person in compressed air until such person has been examined by a physician and found to be fit to engage in such work. If any employee is absent from the work for ten or more successive days, he shall be re-examined before being permitted to resume work in compressed air.

In any event, each compressed air employee shall be re-examined every sixty (60) days as to his fitness to continue work under compressed air.

A medical record shall be kept of every man employed under compressed air, which record shall contain dates on which examinations were made and a clear and full description of the person examined, his age, and physical condition at the time of examination, also a statement as

SPECIFICATIONS—COMPRESSED AIR LOCKS, SANITARY
PRECAUTIONS.

to the time such person has been engaged in like employment. These records shall be kept on suitable examination record forms.

100. Care shall be taken to keep all parts of the tunnels in a thoroughly sanitary condition and free from refuse or decaying matter.

Sanitary
precautions.

101. Air chambers shall be formed in the tunnels by bulkheads of concrete or of steel plate diaphragm construction according to an approved design. The bulkheads and air locks shall be of sufficient strength to sustain with safety a pressure of fifty (50) pounds per square inch. Whenever the air pressure in the heading exceeds twenty-two (22) pounds per square inch above atmospheric pressure, two air chambers shall always be in use, excepting for such time as may be necessary to start headings from the shafts, and the pressure in the outer chamber shall not exceed one-half the pressure in the heading. The distance from the heading to the nearest bulkhead in operation shall not exceed eight hundred (800) feet during the progress of the work. The metal air locks are to be firmly set and anchored in each bulkhead and shall include two or more main locks and an emergency lock. The main locks shall be not less than six (6) feet in diameter. The emergency lock shall be located as high up in the bulkhead as practicable, shall be not less than six (6) feet in diameter, and shall be large enough to hold the entire force employed in the tunnel at any one time, including the time of changing shifts. The emergency lock shall be kept open toward the heading and shall be ready for instant use at all times. The lock or locks regularly used for taking men in and out of any

Tunnel
air locks.

SPECIFICATIONS—CAISSON LOCKS AND EQUIPMENT.

compressed air chamber shall be heated and ventilated and provided with seats.

Caisson
air locks.

In each caisson there shall be provided and kept in service at all times when the caisson is under compressed air, in addition to an air lock for the passage of materials, one (1) metal horizontal air lock not less than five (5) feet in diameter, which shall be large enough to hold all the men employed in the caisson at any one time, including the time of changing shifts. This lock must be kept above mean high water at all times, and when not occupied, shall be kept open toward the working chamber, so as to be ready for instant use as an emergency lock.

Ladder and
rest platforms.

The shaft of the man lock shall be provided with a steel ladder with rungs, and suitable rest platforms spaced not more than twenty-five (25) feet apart, as approved by the Engineer.

Lock
equipment.

Lock doors must operate easily and must be provided with gaskets fitting truly and tightly against the jambs. In each end of each lock is to be set a heavy glass bull's-eye. Air valves must be arranged to be controlled from inside the lock. One of the locks shall be so connected to the main air line that it may be locked in from outside.

Air gauges.

102. The horizontal air lock of each caisson and the man lock in each tunnel bulkhead shall be provided with an air gauge and a clock for the use of the lock tender; in addition, there shall be provided recording air gauges, connected, respectively, with each of the above mentioned locks, with a dial of such size that the amount of change in the air pressure in the lock, within any five (5) minutes, will be readily shown. These gauges shall be enclosed in waterproof boxes, which shall be kept locked and the key shall be in possession of the Engineer. Approved recording air gauges connected with the working chamber

SPECIFICATIONS—COMPRESSED AIR SUPPLY AND CONTROL.

of each caisson, and with each tunnel heading, shall be installed and maintained in the Engineer's office near the shaft by the Contractor without additional cost to the States. An eight and one-half ($8\frac{1}{2}$) inch air gauge shall be placed in an accessible position on the outer side of each bulkhead. Gauges shall be regularly tested and kept in accurate working order at all times.

103. A lock tender shall be on duty at all times in the horizontal air lock of each caisson and in each man lock in each tunnel bulkhead, in addition to the lock tenders on duty at each bulkhead when work is in progress. A watchman shall be on duty at all times in the heading when for any reason the work is suspended.

Lock tender.

104. The air supplied to the caissons and tunnel headings shall be delivered through pipes of such capacity that the drop in pressure under regular working conditions shall not be excessive. There shall be at least two (2) such air supply pipes provided to each caisson with suitable clapper valves at the discharge ends. Two (2) pipes, at least ten (10) inches in diameter shall be used for delivering the air supply from the power house to each land tunnel heading, and two (2) pipes at least fourteen (14) inches in diameter shall be used for delivering the air supply from the power house to each river heading.

Air supply pipes.

The air supply lines shall be kept within fifty (50) feet of the heading and so provided with valves that at all times the fresh air will be discharged both at the heading and just inside the bulkhead nearest the heading.

Each supply pipe shall be provided with a pressure regulating valve and shall be provided with suitable valves arranged for by-passing at a convenient point between the power house and the heading, and shall also

SPECIFICATIONS—SAFETY DEVICES.

be provided with suitable clapper valves at the discharge ends. Special devices shall be used to deaden the noise of air supplied or exhausted. All pipes shall be standard, lap welded.

Air supply.

105. The supply of fresh air to the tunnels and caissons shall be sufficient to permit work without danger or discomfort; and where work is in compressed air, such supply shall be sufficient at all times and places to prevent the accumulation of carbon dioxide to a greater amount than one (1) part in one thousand (1,000) by volume. Two (2) foul air vent pipes at least six (6) inches in diameter shall be carried back from each heading under pressure to normal atmosphere and shall be provided with suitable regulating valves so placed as not to be readily tampered with. The compressors must be run so as to maintain at all times a change of air through the regulating valves. Special means must be provided for the rapid removal of blasting fumes.

Safety screens.

In each tunnel, when the same extends two hundred (200) feet beyond the first bulkhead, the Contractor shall provide a safety screen extending from the springing line of the tunnel to the top of the chamber. It shall be made of at least five-sixteenths ($5/16$) inch steel plate, shall have air-tight joints, shall be substantially braced and shall be of a pattern approved by the Engineer. It shall be moved forward as the shield progresses so that it shall never be more than one hundred fifteen (115) feet in the rear of the shield. For this purpose two (2) such screens shall be used so that one will always be in service while the other is being moved forward.

Runways.

In each tunnel, when the same extends two hundred (200) feet beyond the first bulkhead, the Contractor shall provide above the springing line of the tun-

SPECIFICATIONS—MATERIALS AND WORKMANSHIP.

nel a substantial runway at least three (3) feet wide, leading from the shield platform to a platform at the emergency lock. Each runway shall be provided with a hand-rail and with steps or ladders at frequent intervals for access from the track level. Runways shall be kept clear at all times.

The Contractor shall provide and maintain in service at all times a telephone connection from each heading and each emergency lock to the power house and to the office of the Commissions' engineer near the shaft.

Telephone
connection.

106. Payment for compliance with the requirements relative to compressed air, except as otherwise herein specifically provided, is deemed to be included in the unit prices stipulated in the Schedule for excavation.

Payment for
compressed air
requirements.

SUBDIVISION 7—MATERIALS AND WORKMANSHIP.

107. All materials and workmanship shall be of the best class in every respect, and the Engineer shall be the sole judge of their quality and efficiency.

Best materials
and workman-
ship.

108. Any imperfect construction which may be discovered before the final completion and acceptance of the Works shall be corrected immediately upon the requirement of the Engineer and at the Contractor's expense, notwithstanding that it may have been previously accepted or estimated for payment.

Imperfect con-
struction to be
corrected.

109. Any work of whatever kind which may become damaged from any cause before the final completion and acceptance of the Works shall be broken up or removed and be replaced by good and sound work at the Contractor's expense.

Damaged work
to be replaced.

SPECIFICATIONS—MATERIALS AND WORKMANSHIP.

Condemned
materials to be
removed.

110. If any material brought on the ground for use in the work or selected for the same shall be condemned by the Engineer as unsuitable or not in conformity with the specifications, the Contractor shall forthwith remove such material.

Structures to
be water-tight.

111. It is the intent and purpose of these specifications to secure a structure underground which shall be free from the percolation of water, and to this end methods are herein provided for caulking steel, mixing and placing concrete, caulking and grommets tunnel lining, tightening tunnel bolts and placing and protecting waterproofing to insure a water-tight structure.

Payment for compliance with the requirements of this Subdivision, except as otherwise herein specifically provided, is deemed to be included in the unit prices stipulated in the Schedule.

SUBDIVISION 8—BACKFILLING AND CLEANING UP.

When placed.

112. Wherever excavations are made from the surface, backfilling shall be placed and surface restoration completed, as soon as the progress of the work permits.

Placing and
compacting.

113. Material used in backfilling shall be sand or sand and gravel or other good, clean earth, free from perishable material and from stones exceeding six (6) inches in diameter, and not containing in any place a proportion of stone exceeding one (1) part of stone to five (5) parts of earth. The filling shall be compacted by flooding with water or, in cases where the Engineer considers that flooding with water is not practicable, by ramming in layers not exceeding six (6) inches in depth, as the Engineer may require. No filling of trenches with frozen

SPECIFICATIONS—BACKFILLING AND CLEANING UP.

earth will be permitted nor will any filling be permitted over frozen material.

114. Wherever pipes, sewers or other sub-surface structures are met, the filling must be carefully packed, rammed and tamped under and about such sub-surface structures, special tools being used for the purpose.

Filling around
pipes.

115. As fast as the work of filling permits, sheeting and other timber supporting the sides of the excavations shall, unless otherwise directed, be carefully withdrawn, and the spaces left by the removal of such material shall be carefully backfilled.

Sheeting
removed.

116. At the completion of the work or any part thereof, the Contractor's plant, together with all of its foundations or sub-surface connections, shall be removed and the surface of the ground or street restored to its original condition.

Removal of
plant.

When required by the Engineer, any portion of the completed Tunnel or any part of the surface not used by the Contractor shall be cleared for use of other contractors engaged in the construction of the Vehicular Tunnel. Before final payment is made all parts of the Works shall be cleaned up and put in a condition acceptable to the Engineer.

Cleaning up.

117. Payment for backfilling and cleaning up, except as otherwise herein specifically provided, is deemed to be included in the unit prices stipulated in the Schedule for excavation.

Payment for
backfilling and
cleaning up.

SPECIFICATIONS—EXCAVATION.

SCHEDULE ITEMS.

ITEMS 1-3—OPEN AND COVERED EXCAVATION.

Width to be
limited.

1-1. Special care shall be taken to avoid damage wherever excavation is being done. All excavations shall be of such widths as may be necessary, in the opinion of the Engineer, for the proper and expeditious progress of the work and for protecting, maintaining and changing of pipes, ducts, conduits and other sub-surface structures.

Depth to
be limited.

1-2. Excavations shall be made to such depths as may be necessary to permit the laying of such concrete bed, special foundation or such drain pipes as the Engineer may deem necessary, but if the bottom of any excavation be taken out beyond the limits prescribed, it shall be refilled at the Contractor's expense with concrete or other suitable filling as the Engineer may direct.

Excavations to
be secured.

1-3. The sides of excavations in earth or in unsound rock shall be secured against movement by suitable sheet piling, or sheeting held in place by suitable waling or bracing timbers, or suitable retaining walls, special precautions being taken where there is additional pressure due to the presence of railroad tracks, buildings, tanks or other structures.

Measurement
of excavation
from surface.

1-7. Measurements for payment for any excavation made from the surface will be governed by the net or neat lines, as ordered and indicated on the drawings, of the sides and bottom of the structure for which the excavation is made, within which lines no unexcavated material nor other material not indicated on such draw-

SPECIFICATIONS—EXCAVATION.

ings will be permitted to remain. The volume to be estimated for payment for any excavation made from the surface, except for the additions hereinafter provided for in this Section and in Section 1-11, will be limited to the volume formed by the projection of such net or neat lines vertically upward to the surface, it being understood that there is thus defined the volume of the material in place before its removal included vertically above such net or neat lines between lines extending vertically upward from the lateral extremities of such net or neat lines to the surface. The lines bounding the volume so formed shall be deemed to be the ordered net lines of excavation for any excavation made from the surface.

In estimating volumes no addition will be made for slips or slides or for swelling or increase in volume after removal, nor will any volume be measured more than once within the same space; but no deduction will be made for spaces under sidewalks, for basements or cellars or for spaces occupied by sewers, pipes or other sub-surface structures.

In excavations in ledge rock the volume to be estimated for payment will include, in addition to the volume within the ordered net lines of excavation, the volume extending nine (9) inches horizontally outside such lines for the sides of the structure below the rock surface.

Additional
estimate in
ledge rock.

No excavation not forming part of a wider excavation, will be estimated for payment at less than three (3) feet in width.

1-11. In all excavations for changing any such water, gas or other pipe as are enumerated in the Schedule,

Measurement
of excavations
for pipes.

SPECIFICATIONS—EXCAVATION.

and in excess of excavations otherwise required, the volume to be estimated for payment will include, in addition to the volume within the ordered net lines of excavation for such pipe, the volume extending outside such lines to vertical lines twelve (12) inches [or eighteen (18) inches if the interior diameter of such pipe is thirty (30) inches or more] horizontally distant from the extremities of the horizontal interior diameter of such pipe and above horizontal lines six (6) inches below the outside of barrel of such pipe. The ends of payment excavation shall be limited by vertical planes twelve (12) inches beyond the ends of the newly set pipe.

In excavations for hydrants, valves, valve boxes and valve chambers appurtenant to such pipes, the volume to be estimated for payment will include, in addition to the volume within the ordered net lines of excavation, the volume extending twelve (12) inches horizontally outside such lines for the sides of such appurtenance above horizontal lines six (6) inches below its lowest point.

Payment for
excavation
from surface.

1-13. Payment for excavations made from the surface will be at the price stipulated in Schedule Item:

1. For earth excavation, both above and below mean high water (except tunnel excavation and shaft excavation), but including excavation for pipes, ducts and conduits;

for the volume of excavation measured as hereinbefore provided.

SPECIFICATIONS—SHAFT EXCAVATION.

Such payment shall be in full compensation for all excavation, whether within or without the payment lines, and all expense in connection therewith or incidental thereto, it being understood that allowance is included in such stipulated price for all excavation in excess of that limited by the payment lines, for all sheeting, bracing, timbering, fencing, decking and bridging, for maintaining and supporting trenches during and after excavation, for the removal and disposal of all excavated and other materials, for all pumping, bailing and use of compressed air, for lighting, for backfilling, and for all such protection, maintenance, support, reconstruction and restoration of buildings, parts of buildings, railroad tracks or other surface, sub-surface and overhead structures of whatever nature, and their appurtenances, as are not specifically provided to be paid for at or in other classified unit prices of the Schedule.

ITEMS 4-6—SHAFT EXCAVATION.

4-2. The land shafts will consist, in part, of reinforced concrete caissons with steel bulkheads and roofs. The concrete walls shall be placed to a height of at least fifteen (15) feet above the position of the working chamber roof before compressed air is applied.

Land shaft
caissons.

The river shafts will consist of steel caissons with double steel walls, the spaces between the walls to be filled with concrete. A concrete and granite protection will be placed around the upper portions of the shafts. All concrete in these walls and all protection concrete and masonry shall be placed above mean high water.

River shaft
caissons.

SPECIFICATIONS—SHAFT EXCAVATION.

Sinking
caissons.

4-3. Both land and river caissons shall be sunk by the compressed air method and so supported at all times, as to insure the proper control of each caisson and to prevent disturbance to adjacent structures. The Contractor shall submit to the Engineer for approval detailed plans for doing this work. Every precaution shall be taken to protect and control the caissons, using the necessary jacks, blocking, wedging, supports or other measures for guiding and stopping the caissons at the proper elevations, so that when in their final positions, the cutting edge of each caisson shall not be more than eight (8) inches from the alignment shown on the drawings nor more than one (1) inch out of level in twenty (20) feet measured in any direction, nor more than three (3) inches from the theoretical elevation.

The river shaft caissons shall be so supported from the top at all times as to insure their being kept in a vertical position. The method used for supporting and sinking the river caissons shall include ample provision to prevent tipping and abrasion of the protection concrete and granite facing.

Caisson inverts.

4-4. The waterproofing and the concrete inverts of the shaft caissons shall be placed as shown on the contract drawings and specified in Sections 27-23, 60-6 and 60-7. After the caissons have been sunk to final position; and, in the case of the river shaft caissons, the inverts shall be joined to the supporting piles as specified in Section 52-3.

SPECIFICATIONS—SHAFT EXCAVATION.

4-5. After the completion of the land shafts, shields shall be erected in the two shafts, one for driving the tunnel landward and one for driving toward the river, after which the roofs shall again be placed and the construction of the tunnels carried far enough to permit the building of tunnel bulkheads. The roofs of the working chambers shall then be removed and the other shields placed in the two shafts. The roofs of the working chambers shall again be put in position and the tunnels started in the opposite direction.

Sequence of
land shaft
operations.

The river shaft caissons have two connections for the roofs of the working chambers, the lower ones to be used while sinking the caissons and placing the water-tight floors, and the upper ones to be used while the shaft bulkheads in the sides of the caissons are removed under compressed air for the passage of the tunnel shields through the shafts. After the shields have passed through the shafts and a sufficient length of tunnel has been constructed, tunnel bulkheads shall be erected. Before air pressure is removed from the caissons, a cross passage shall be built between the river shafts. After the locks of the tunnel bulkheads are in operation and the cross passage between the river shafts is completed, the roofs of the working chambers shall be removed and stored so they can be replaced, if necessary, during tunneling operations.

Sequence of
river shaft
operations.

In both land and river shafts, the roofs of the chambers, temporary roof bracing and bulkheads closing the shield openings in the sides of the shafts, will not form a

SPECIFICATIONS—SHAFT EXCAVATION.

part of the completed work and will be considered plant, which will become the property of the Contractor at the completion of the work.

In both land and river shafts, no specific payment will be made for placing and removing the chamber roofs, temporary roof bracing or the bulkheads closing the shield openings in the sides of the shafts, but payment for all such work is deemed to be included in the unit prices stipulated in the Schedule.

The sequence of operations defined in this Section is intended to secure as far as practicable the safety of each operation conducted under the use of compressed air. The Contractor may adopt some other sequence of operations provided that, in the opinion of the Engineer, equal or greater safety may be secured thereby.

Measurement
and payment,
shaft items.

4-6. Excavation for the shaft caissons will be measured for payment as provided in Section 1-7 except that the net or neat lines instead of being projected vertically will be projected parallel to the vertical or nearly vertical axis of the caisson. Payment excavation is to be limited to the position of the caissons required under Section 4-3.

The upper limit for the measurement of earth excavation in the river shafts will be mean high water (Elevation 300).

Payment for shaft excavation will be at the price stipulated in Schedule Item:

SPECIFICATIONS—SHAFT EXCAVATION.

4. For shaft excavation in earth, above mean high water;
5. For shaft excavation in earth, below mean high water; or
6. For shaft excavation in rock.

Such payment shall be in full compensation for excavation as defined in the last paragraph of Section 1-13, but no partial payment will be made for shaft excavation in earth for the river shafts until the entire cutting edge of the caisson is buried in material sufficiently firm to support the caisson from the bottom.

All steelwork of the shaft caissons will be paid for as provided in Section 70-50 at the price stipulated in Schedule Item 71 or 73. Payment for steelwork in connection with the shafts, other than steelwork specifically defined as part of the shaft caissons, will be made at the appropriate unit price stipulated in the Schedule.

Piles, concrete and waterproofing in the shafts will be measured as provided in Sections 27-27, 52-4 and 60-14 and paid for at the appropriate unit prices stipulated in the Schedule.

ITEMS 8-12—TUNNEL EXCAVATION.

8-1. Shields shall be used in excavating the tunnels, except the cross passage connecting the river shafts. The design shall make adequate provision for the safety of the workmen and for the application of safe methods for protecting the face of the heading. The rear over-

Shields.

SPECIFICATIONS—TUNNEL EXCAVATION.

hang or tail shall be long enough to extend twelve (12) inches back of the joint between the last two (2) rings erected when the shield is in position to erect another ring. The shield shall be built to a true circle and riveted as far as practicable. The jacks or rams shall be of sufficient number and so spaced as to distribute their reactions safely against the tunnel lining and shall be of sufficient power to move the shield along the line and grade shown on the drawings. The hydraulic pumps for operating the jacks shall be located on the surface. The drawings for the shields shall be submitted to the Engineer for his approval previous to the construction of the shields, but such approval shall not relieve the Contractor from responsibility for the adequacy and safe operation of the shields.

Starting shields
from shafts.

8-2. In starting and driving the shields through the openings provided in the sides of the shafts, the Contractor shall provide satisfactory means for their support and to take the pressure of the shield jacks and distribute it against the sides of the shafts in such a manner as to cause no injury to the permanent work. As soon as practicable after the shields have passed through these shaft openings, the Contractor shall install bulkheads and locks in the tunnels.

Supporting
Pier 8,
Erie Railroad.

In tunneling beneath the slip between Pier No. 8 and Pier No. 9 of the Erie Railroad, the Contractor will be required to support Pier No. 8 in a manner satisfactory to the Chief Engineer of said Railroad, so that its use will be unimpaired during the period of tunnel driving. No specific payment will be made for this work, but compensation therefor is deemed to be included in the unit prices stipulated in Schedule for excavation.

SPECIFICATIONS—TUNNEL EXCAVATION.

In removing the bulkheads to admit the shields on the west side of the river shafts, every precaution shall be taken by the Contractor for the safety of the work and for building the tunnel on the required line and grade. Before the shields are within forty (40) feet of the river shafts, the Contractor shall provide at his expense means for checking the tunnel line and grade with that of the shafts. In advancing the shields through the shafts and through the openings on the east side, the same precautions shall be observed as required at the land shafts and as stated in the preceding paragraph. As soon as practicable after the shields have passed beyond the river shaft caissons, the Contractor shall install bulkheads and locks in the tunnels east of the shafts.

Shields at
river shafts.

8-3. The methods used for advancing the shields shall be such as to assure its control at all times without binding or imposing excessive loads on the tunnel lining. Such operations shall further be conducted so as to avoid excessive escape of air or inflow of materials and the Contractor shall employ all suitable means to this end, such as polings, breast-boards, clay or other suitable materials to stop excessive air leakage at any point, particularly at the face of the heading and through the space between the tail of the shield and the tunnel lining. The grouting of the annular space around the tunnel lining shall be kept as close as practicable to the shield. Special care shall be taken in all shield operations in the vicinity of buildings, in entering or leaving the shafts or passing under bulkheads, piers or other structures, and, as herein elsewhere provided, the Contractor shall be responsible for any injury thereto resulting in any way from his operations.

Shield
operations.

SPECIFICATIONS—TUNNEL EXCAVATION.

Shields to be driven to line and grade.

8-4. Shields must be driven and the tunnel built accurately to the alignment and grade shown on the drawings. The Contractor shall employ such methods of excavation, such use of jacks or such other means as may be necessary to secure this result. Any work which, in the opinion of the Engineer, is not so built, must be removed and replaced by the Contractor and he shall be entitled to no extra compensation therefor.

Data for guiding shields.

The Engineer will furnish the Contractor with the necessary data for the guidance of the shields and the Contractor will be required in advancing the shields to take the necessary steps to overcome any tendency toward a variation from the required line and grade.

Tunnel lining maintained in position.

Following the erection of the tunnel lining behind the shields the Contractor shall maintain this lining in its proper position, using the necessary loading, bracing or such other means as may be necessary, as well as doing the necessary caulking to prevent leakage.

Concrete invert in rock.

8-5. Where the bottom of the tunnel is in rock, except as provided in Section 8-6, a concrete cradle of the width shown on the contract drawings and built to the required line and grade shall be placed for the purpose of supporting the shield. Steel rails or plates upon which to slide the shield shall be imbedded in the concrete.

Excavation in rock.

8-6. Excavation in rock or other hard material, beyond that necessary to permit the passage of the shield, must be avoided as far as practicable.

In passing from rock to earth excavation or in passing from earth excavation to rock the Contractor shall excavate below the cutting edge of the shield a distance of

SPECIFICATIONS—TUNNEL EXCAVATION.

nine (9) inches and pack with clay or other approved material wherever the rock section spans a width less than the lower quarter of the shield.

8-7. In all excavations made without the use of a shield, timber shall be used wherever necessary to support the excavation and to protect the work and the workmen. The size and spacing of timbers and the thickness of lagging shall be as the nature of the ground may require. The bents shall be kept tightly wedged and securely footed at all times, and sufficient packing shall be used over the timbers to prevent falls.

Tunnel
timbering.

At the west end of the contract, the Contractor shall place such approved bulkheads as may be necessary; no separate payment will be made for these bulkheads, but payment therefor is deemed to be included in the unit prices stipulated in the Schedule for excavation.

Bulkheads at
west end of
contract.

8-8. A permanent blanket will be placed over the tunnels under Contract No. 3 as described in Sections 21-1 and 21-4.

Permanent
blanket.

8-9. The Contractor shall provide and maintain, during the period that the shields are being driven underneath, a temporary blanket in the bed of the river, of approved clay or other approved material of sufficient width and thickness to counteract the unbalanced air pressures. The Contractor shall remove, upon or before the completion of the work hereunder, every part of such blanket beyond the pierhead line extending above a plane fifty-five (55) feet below mean high water. Ridges or other obstructions due to the Contractor's operations shall be removed at once if required by the Engineer. Inside the pierhead line, the Contractor shall remove the temporary blanket to such an extent as to leave the depth of water as great as existed before the blanket was deposited.

Temporary
blanket.

SPECIFICATIONS—SOUNDINGS, TRANSPORTING MATERIALS.

The Contractor shall strictly comply with the provisions of the permit of the Secretary of War dated January 24, 1920 (a copy of which is printed as part of this contract in the appendix to the specifications) regarding the placing of such temporary blanket.

No specific payment will be made for the work referred to in this Section, but payment therefor is deemed to be included in the unit prices stipulated in the Schedule for tunnel excavation.

Soundings.

8-10. As soon as the shields have passed beyond the river bulkhead the Contractor shall take daily soundings to determine the position and thickness of the covering over the tunnels and shall furnish the Engineer with a copy of the records. The position of such soundings will be located by the Engineer.

Cars and
tracks.

8-11. Cars for transporting materials through the tunnels shall be of substantial design, shall be tight and shall at all times be so handled as to assure safety of operation. There shall be at least two (2) tracks for material cars between each heading and the nearest bulkhead in operation. Tunnel service tracks shall be maintained at good grade and alignment and the entire track floor from one side of the tunnel to the other shall be planked in an approved manner between each shield and the nearest bulkhead in operation. From this bulkhead to the shaft the Contractor shall maintain in good condition, a planked walk at least three (3) feet wide at the level of the track floor. The system of haulage shall be mechanical and readily controllable. No animals shall be used for haulage in the tunnels except in such special cases as the Engineer may permit.

SPECIFICATIONS—TUNNEL EXCAVATION.

8-12. Cages shall be used in the shafts for hoisting men and materials during the construction of the tunnels and full precautions shall be taken to insure perfect safety. These precautions shall include safety catches of best design with bronze or bronze-bushed bearings, landing dogs at all landings, safety dogs on all tracks leading to the cages, and effective devices for the prevention of over-winding. All parts of the hoisting apparatus, cables, brakes, guides and fastenings shall be of the most substantial design and shall be arranged for convenient inspection. The efficiency of all safety devices shall be established by satisfactory tests before the cages are put into service and at least once every three (3) months thereafter. Cages shall be provided with strong protective roofs, and shall be suitably covered or protected with wire netting at the sides. The cage opening shall be protected by sliding or lifting gates or by a trap door cover, worked automatically. At the bottom of the shaft there shall be provided a protected walk for the passage of men around the cage way. Effective and reliable signalling devices of an approved design shall be maintained at all times to give instant communication from the foot of the shaft directly to the hoist room. In each shaft there shall be a covered stairway at least two and one-half ($2\frac{1}{2}$) feet wide leading from the bottom of the shaft to the surface.

Cages and shafts.

8-13. The tunnel lining shall be erected in the manner provided in Section 90-14 and shall be made water-tight in the manner described in Sections 60-15, 60-16 and 60-17.

Erection of tunnel lining.

8-14. Voids outside the tunnel lining shall be grouted as specified in Sections 45-3 to 45-6, inclusive.

Voids to be grouted.

SPECIFICATIONS—TUNNEL EXCAVATION.

Measurement
and payment,
tunnel
excavation.

8-15. Measurements for payment for any tunnel excavation will be governed by the net or neat lines, as ordered and indicated on the drawings, of the structure for which the excavation is made, and such lines are deemed to be the ordered net lines of tunnel excavation within which no unexcavated material nor other material not indicated on such drawings will be permitted to remain. Volumes for payment will be estimated as of the material in place before its removal within the payment lines hereinafter described in this Section and as indicated on the drawings.

In estimating volumes no addition will be made for material removed outside the payment lines whether due to slips, slides, timbering or other cause, nor will any addition be made for swelling or increase in volume after removal; and no deduction will be made for material left within the payment lines, provided that such material will not interfere with placing the structure or moving the shield where a shield is used. No volume will be estimated for payment more than once within the same space.

In tunnel excavation, including cross passage excavation, volumes for payment will be estimated as extending in earth to a line four (4) inches radially outside the exterior surface of the tunnel lining, and in ledge rock to a line nine (9) inches radially outside the exterior surface of said lining, as ordered and indicated on the drawings.

In estimating volumes according to the classification of tunnel excavation the limits between excavation wholly in earth or wholly in rock and excavation partly in earth and partly in rock shall be the vertical sections at points where the surface of ledge rock in place intersects the payment line for excavation in rock.

Payment for tunnel excavation will be at the price stipulated in Schedule Item:

SPECIFICATIONS—TUNNEL EXCAVATION.

8. For tunnel excavation wholly in earth;
9. For tunnel excavation partly in earth and partly in rock; or
10. For tunnel excavation wholly in rock;

for the volume of excavation measured as provided above in this Section; and such payment shall be in full compensation for all excavation, whether within or without the payment lines, and all expense in connection therewith or incidental thereto, it being understood that allowance is included in such stipulated price for all excavation in excess of that limited by the payment lines, for all lagging, breasting, bracing and timbering, for the removal and disposal of all excavated and other materials, for all pumping, bailing and use of compressed air, for lighting, for the use of clay in and about the tunnel, for depositing and removing clay blankets or other tunnel covering as described in Sections 8-8 and 8-9, for all additional grouting as described in Section 45-7, for all backfilling and surface restoration due to disturbance caused by tunneling operations, for tearing down, removing and disposing of piers, bulkheads and buildings, and for all such protection, maintenance, support, reconstruction and restoration of piers, bulkheads, buildings or parts of buildings and other surface, sub-surface and overhead structures of whatever nature, and their appurtenances, as are not specifically provided to be paid for at or in other unit prices stipulated in the Schedule.

8-16. Concrete in shield cradles will be measured as provided in Section 27-27, and paid for at the price stipulated in Schedule Item 28 (d).

Tunnel lining, including all caulking of the joints, will be measured as provided in Sections 88-11, 88-12 and

Measurement
and payment,
other tunnel
items.

SPECIFICATIONS—SHIELD JUNCTIONS.

and 90-16, and paid for at the price stipulated in Schedule Item 88 or 90.

Bolts, nuts and washers connecting the segments of the tunnel lining, including all grommets of the bolts, will be measured as provided in Section 70-50, and paid for at the price stipulated in Schedule Item 76(a).

Grouting behind tunnel lining will be measured as provided in Section 45-8, and paid for at the price stipulated in Schedule Item 47 or 48 for grout containing Portland cement or in Schedule Item 49 or 50 for grout containing mixed cement.

ITEMS 16-19—SHIELD JUNCTIONS.

Junction
between Con-
tract No. 3
and Contract
No. 4.

16-1. It is expected that the shields of Contract No. 3 and Contract No. 4 will meet in rock or in part earth part rock at the point shown on the contract drawings, subject to the determination by the Engineer, as provided in Article XXVIII. As soon as the first shield in either the north tunnel or in the south tunnel, under either contract, reaches the junction point between the two contracts, as the Engineer shall determine, the contractor driving such shield shall erect a temporary bulkhead at the face of the shield and securely pack the space between the tunnel lining and the tail of the shield to prevent loss of air and inflow of materials. The temporary bulkhead shall be of sufficient strength to withstand pressure from the approaching shield, and shall contain suitable provision for a line and grade check before shield junction. Such contractor shall remove from his shield all hydraulic or other special equipment which he wishes to salvage, but shall otherwise leave the shield intact, and shall erect a concrete or steel junction bulkhead provided with an air lock at least six (6) feet in diameter, arranged with double doors at each end so that the pressure on either side of the bulkhead will be in-

Junction
bulkheads.

SPECIFICATIONS—SHIELD JUNCTIONS.

dependent of the pressure on the other side. The junction bulkhead will be located about fifteen (15) feet behind the shield.

After the heading is properly bulkheaded, the air pressure may be reduced or removed upon the approval of the Engineer. This contractor must, however, maintain a compressed air line to the shield chamber beyond the junction bulkhead and, upon the approach of the other shield, he must raise the air pressure at the heading to equal that of the approaching shield, and shall furnish compressed air and lock tenders for this purpose until the two headings are connected.

16-2. When the temporary shield bulkhead referred to above is built, provision shall be made for checking line and grade before the shields meet, either by driving a pipe or a small drift about forty (40) feet ahead of the shield, as the Engineer may require. Payment for furnishing and driving the pipe will be made in the manner provided in Schedule Item 300; payment for the drift will be made at the appropriate unit price stipulated in the Schedule for tunnel excavation. The volume of such excavation allowed on one contract will be deducted from the adjoining contract.

Line and
grade check.

16-3. The Contractor driving the shield last to reach the junction point shall assume control and operation of the junction bulkhead immediately after the headings are connected, shall supply air for the shield chamber, dismantle and dispose of the shields of both contracts, complete the junction of the tunnel lining, place the concrete lining and complete the tunnel structure to a point within fifteen (15) feet of the junction bulkhead, and he shall assume all responsibility for the work at the shield junction, including the maintenance of the junction bulkhead,

Removal of
shield and
junction of
tunnel lining.

SPECIFICATIONS—SHIELD JUNCTIONS.

except that the final operation and disposal of this bulkhead will be as provided for in the following Section.

Removal of
junction bulk-
heads and
junction of con-
crete lining.

16-4. The contractor last to remove compressed air from either tunnel shall, upon the removal of compressed air from the corresponding tunnel on the adjacent contract, assume control and operation of the junction bulkhead, and he shall, upon the removal of air in his section of the tunnel, take down the junction bulkhead, the lock and equipment of which becomes his property, make tight the tunnel lining and join the concrete lining to the concrete lining of the adjacent contract; such junction point of the concrete lining in either case to be within fifteen (15) feet of the junction bulkhead.

Payment for
work at
junction of
contracts.

16-5. Payment for all work or materials in connection with the junction of the two contracts, including the placing of the temporary shield bulkheads, the furnishing of compressed air, the maintenance of locks and lock-tenders, and all risks involved in connection with such junctions, the placing and making water-tight the tunnel lining, including lining erected by the other contractor, the placing of concrete lining and the completion of the tunnel structure, and all other work in connection therewith or incidental thereto, is deemed to be included in the appropriate unit prices stipulated in the Schedule, and no further allowance will be made therefor, except that:

(1) Payment for junction bulkheads will be made at the lump sum price stipulated in Schedule Item 16, which price per bulkhead shall include the furnishing and erection of the junction bulkhead with locks, pipes, valves and connections complete and all expense in connection therewith or incidental thereto.

(2) Payment for the disposal of junction bulkheads

SPECIFICATIONS—SHIELD JUNCTIONS.

will be made at the lump sum price stipulated in Schedule Item 17, which price for the disposal per bulkhead shall include the taking down of the bulkhead, disposal of all material, protection to the tunnel lining and all expense in connection therewith or incidental thereto.

(3) Payment for dismantling and disposing of the shields will be made at the lump sum price stipulated in Schedule Item 18, which price per shield shall include the taking down of the shield structure (except the skin plates), and all expense in connection therewith or incidental thereto.

(4) Provisions for line and grade checks with the approaching shield will be estimated for payment as elsewhere herein provided.

SCHEDULE ITEMS NOT LISTED UNDER CONTRACTOR'S
PROPOSAL—FORM "B"

16-6. Schedule Items 16, 17 and 18 do not appear in Form "B" of the proposal and in case Contract No. 3 and Contract No. 4 are awarded to the same bidder the junction bulkheads and other provisions solely required to separate the work of the two contracts at the point of shield junction will be omitted and the above mentioned items will not appear in the payment schedule of the contract under Form "B," but the cost of all labor and materials involved in shield junction and in connecting up of tunnel lining and all other work in connection therewith or incidental thereto is deemed to be included in the unit prices stipulated in the Schedule for tunnel excavation.

SPECIFICATIONS—PERMANENT BLANKET.

ITEM 21—PERMANENT BLANKET OVER THE TUNNELS AND
MAINTENANCE OF 1,000 FT. CHANNEL.

Permanent
blanket over
the tunnels.

21-1. Where the present river bed is below a plane fifty-five (55) feet below mean high water, the Contractor of Contract No. 3 will deposit a permanent blanket over the tunnels as shown on Contract Drawing No. 30 of Contract No. 3, extending from the river bed up to the elevation mentioned above. The entire permanent blanket will be placed by the Contractor of Contract No. 3, although a portion of this blanket may extend west of the division line between Contract No. 3 and Contract No. 4, as shown on the contract drawings. This blanket will be completed as least six (6) months in advance of tunneling operations under either contract at this part of the river.

Contractor to
maintain.

21-4. If the Contractor herein deposits a temporary blanket over the permanent blanket, he shall remove the temporary blanket at the completion of tunneling operations, and if in so doing he should disturb the permanent blanket either east or west of the division line between the two contracts, he shall at his own expense restore this blanket to its former condition in a manner approved by the Engineer.

Commissions
to maintain
1,000 foot
channel.

21-6. Section 16 of the permit granted to the Commissions by the Secretary of War provides that a channel one thousand (1,000) feet wide and forty-five (45) feet deep below mean high water [forty (40) feet below mean low water] shall be maintained at all times at the expense of the permittee. Since the permit was issued, the United States Government has dredged a channel forty-five (45) feet deep in the vicinity of the proposed tunnels, and in case the United States District Engineer, in accordance with the permit granted to the Commissions, should require any extra dredging or maintenance of the channel,

SPECIFICATIONS—CEMENT.

in addition to the Contractor's work of removing the temporary blanket and other obstructions caused by his operations, as elsewhere herein provided, such extra dredging or maintenance of the channel will be done by and at the expense of the Commissions.

ITEM 25—CEMENT.

25-1. All cement used in the work, except where mixed cement is required, shall be true Portland cement, by which is meant the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination excepting water and calcined or uncalcined gypsum.

Portland
cement.

25-2. Before any cement is furnished, the brand shall receive the approval of the Engineer. Cement, to be acceptable, shall be of a well-known brand which has been in successful use for large engineering works in the United States for at least five (5) years and which has an established reputation for uniform character. Preference will be given to cements which, by their records, show a tendency to maintain high strength of mortar with increased age.

Brand to be
approved.

25-3. Cement shall be subject to inspection at the place of manufacture and on the work and to such tests as may be ordered by the Engineer. The Engineer and his representatives shall have access at all times and places to inspect the methods of manufacture, storage and protection and shall have liberty to inspect the daily laboratory records of tests and analyses at the cement works.

Inspection.

25-4. Unless otherwise directed, samples will be taken

Tests.

SPECIFICATIONS—CEMENT.

at the place of manufacture by a representative of the Engineer and sent to the Commissions' laboratory, where the tests will be made. If required, tests will be made on the individual samples without intermixing. Methods of testing by the Engineer will, in general, conform to the methods recommended by the Committee on Uniform Tests of Cement of the American Society of Civil Engineers, but the Engineer shall have the right to apply any other tests which he may desire in determining the acceptability of the cement. Cement kept in storage several months may be subjected to repeated tests if required by the Engineer.

In the case of cement used in concrete for the protective coating on the outside of the river shaft caissons the Engineer may require brands of cement that will meet physical and chemical requirements other than those stated below.

Specific gravity
and color.

25-5. Portland cement shall have a specific gravity of not less than 3.10 nor more than 3.25 after being thoroughly dried at a temperature of 212 degrees F. The color shall be uniform, bluish gray, free from yellow or brown particles.

Chemical
analyses.

25-6. Chemical analyses of cement made from time to time shall show a reasonably uniform composition. Portland cement shall contain not more than 1.75 per centum of sulphuric anhydride (SO_3) nor more than 4 per centum of magnesia (MgO).

Fineness.

25-7. Portland cement shall be of such fineness that it shall leave a residue, by weight, of not more than twenty-two per centum (22%) on a No. 200 sieve, the wires of the sieve being 0.0024 inch in diameter.

Time of setting.

25-8. Portland cement shall not develop initial set in

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less than forty-five (45) minutes as determined by the Vicat needle test, unless a more quickly setting cement is specifically required, and shall develop final set in not less than one (1) hour nor more than ten (10) hours.

25-9. Tests for soundness, unless otherwise required by the Engineer, will be made in the following manner: Three (3) pats of neat cement of normal consistency about three (3) inches in diameter, one-half inch thick at the center and tapering to thin edges, shall be made on clean glass plates and kept in moist air for a period of twenty-four (24) hours. The pats are then to be treated and observed as follows: Soundness.

(a) A pat is to be kept in air at normal temperature, and observed at intervals for at least twenty-eight (28) days.

(b) A pat is to be kept in water maintained as near 70° F., as practicable, and observed at intervals for at least twenty-eight (28) days.

(c) A pat is to be placed in water at normal temperature, which is gradually (in about half an hour) raised to boiling temperature and maintained there for five (5) hours.

The pats, to pass the requirements satisfactorily, shall remain firm and hard and show no signs of distortion, blotching, checking, cracking or disintegration.

25-10. Neat Portland cement briquettes shall have at the end of one (1) day in moist air a breaking strength, per square inch of sectional area, of not less than one hundred fifty (150) lbs., at the end of seven (7) days—one (1) day in moist air, six (6) days in water— Tensile strength.

SPECIFICATIONS—CEMENT.

of not less than five hundred (500) lbs., and at the end of twenty-eight (28) days—one day in moist air, twenty-seven (27) days in water—of not less than six hundred (600) lbs., but in any case shall not show deterioration in strength over the seven (7) day test.

Mortar briquettes, composed of one (1) part of Portland cement and three (3) parts of standard Ottawa sand, by weight, shall have at the end of seven (7) days—one (1) day in moist air, six (6) days in water—a breaking strength, per square inch of sectional area, of not less than two hundred (200) lbs.; and at the end of twenty-eight (28) days—one (1) day in moist air, twenty-seven (27) days in water—of not less than three hundred (300) lbs. The strength at twenty-eight (28) days shall show an increase of not less than fifty (50) lbs. over the strength at seven (7) days.

Long-time
tests.

25-11. Tests will be made from time to time extending over longer periods than twenty-eight (28) days. If such tests show a tendency to unsoundness or unusual reduction in strength with increased age, the Engineer shall have the right to prohibit the further use of the brand of cement showing such tendency and to require that another brand be substituted therefor.

Natural
cement.

25-12. Natural cement approved by the Engineer may, when mixed with Portland cement, be used in grouting immediately behind the shields. The mixing of the two cements shall be of such proportions as the Engineer may require and shall be done at the mill where the cement is manufactured. Such mixture shall hereinafter be referred to as mixed cement.

Mixed cement.

Storage during
tests.

All cements, both Portland and natural, shall be held in storage to allow ample time for tests to be made before the cement is required for use.

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25-13. Cement shall be packed and delivered in canvas sacks or other strong, well-made packages, plainly marked with the manufacturer's brand and sealed in an approved manner. The weights of such packages shall be uniform. Packages received in broken or damaged condition, or packages which are under weight, may be rejected, or accepted only as fractional packages.

Packing.

25-14. The Contractor shall at all times keep in store on the work or at some point convenient thereto an abundant supply of cement, so as to guard against possible shortage. It shall be stored in a weather-tight building with a tight floor a proper distance above the ground and with sufficient floor space to admit of storing each lot of cement of not more than two hundred (200) barrels, or its equivalent, separately, so as to facilitate identification of each individual lot in case of necessity for further tests or rejection. Bags shall be piled uniformly in tiers, with a uniform number of tiers in a row, so that they can be readily counted. Cement that has become partially set or otherwise damaged shall not be used.

Storage
on work.

25-15. For all purposes for which cement may be used, three hundred seventy-six (376) pounds net will be considered a barrel of Portland cement and two hundred eighty-two (282) pounds net will be considered a barrel of natural cement.

Barrel of
cement.

ITEMS 27-29—CONCRETE MASONRY.

27-1. Concrete shall consist of a mixture of cement, fine aggregate, coarse aggregate, and clean, fresh water.

Composition.

27-2. Fine aggregate for concrete shall consist of sand having clean, hard, strong, durable, uncoated grains,

Fine aggregate.

SPECIFICATIONS—CONCRETE.

free from soft or flaky particles, loam, alkali, organic matter or other deleterious substances. It shall be graded from fine to coarse, to the satisfaction of the Engineer, and it shall contain no grains which will not pass a one-fourth ($\frac{1}{4}$) inch screen, nor more than six per centum (6%) by weight which will pass a one-hundred (100) mesh screen.

The sand shall be of such quality that mortar composed of one (1) part of Portland cement and three (3) parts of sand by weight will have a tensile and compressive strength equal to mortar of the same consistency made from one (1) part of the same cement and three (3) parts of standard Ottawa sand.

Coarse
aggregate.

27-3. Coarse aggregate for concrete shall consist of sound, hard, strong, clean gravel or sound, hard, strong, broken trap rock, or a mixture of such gravel and broken stone, as determined by the Engineer. If a mixture of gravel and broken stone is used, the Engineer may require that the gravel and broken stone be stored separately on the work and mixed in single batches as needed.

Size of coarse
aggregate.

27-4. The gravel or broken stone or the mixture of gravel and broken stone for concrete shall be graded from fine to coarse to the satisfaction of the Engineer, and that which is all of one size, or practically so, shall not be used. It shall be screened or washed sufficiently to remove all dust, loam, clay or other deleterious matter and unless otherwise required, it shall contain no pieces that will pass through a hole three-eighths ($\frac{3}{8}$) inch in diameter and no pieces that will not pass through a hole one (1) inch in diameter. Gravel or broken stone, graded as above, but between three-eighths ($\frac{3}{8}$) and one and three-fourths ($1\frac{3}{4}$) inches in diameter, will be required for concrete in certain parts of the work.

Sand, as the fine aggregate, and gravel or broken

SPECIFICATIONS—CONCRETE.

stone, as the coarse aggregate, shall be separately stored and separately measured in the charging boxes for the mixer.

27-5. Concrete shall in general be proportioned of one (1) part of cement, two (2) parts of sand, and four (4) parts of stone, but the Engineer may, if in his judgment conditions so require, decrease the volume of stone.

Proportions.

Whenever the Engineer requires that the mixture of concrete be changed from one (1) part of cement, two (2) parts of sand and four (4) parts of stone to a mixture containing a less proportion of stone, payment volume for the concrete so placed will be increased in proportion to the decrease of volume resulting from the differently proportioned mixture of concrete as determined by field tests. The above does not apply to mortar batches where all stone is omitted, referred to in Sections 27-21.

For purposes of mixture, three hundred seventy-six (376) pounds of Portland cement shall be estimated at three and five-tenths (3.5) cubic feet of volume. The proportional parts of sand and stone shall be by volume, as cast into the measuring box.

Weight and volume of a barrel of cement.

The proportion of water shall be at all times as approved by the Engineer, and generally such as to make the concrete of plastic consistency so that it can be properly placed, but at all times dry enough to prevent separation of material and to keep water or grout from pooling on the surface when spaded in the forms.

Consistency.

27-6. Concrete shall be machine-mixed whenever practicable. A rotary machine of a pattern approved by

Mixing by machine.

SPECIFICATIONS—CONCRETE.

the Engineer and mixing only one batch at a time shall be used.

Time of
mixing.

The mixing shall be thorough and uniform and shall be continued at least one (1) minute after all materials are in the mixer but the protection concrete placed around the outside of the river shaft caissons shall be mixed at least two (2) minutes after all materials are in the mixer.

Mixing by
hand.

27-7. When the Engineer considers it impracticable to mix concrete by machine, it may be mixed by hand, according to methods approved by the Engineer.

Mixing ar-
rangements to
be approved.

27-8. The mixing plants and their locations shall be as approved by the Engineer. Concrete shall be mixed as close as practicable to the point of deposit, but mixing will generally not be permitted on the street surface.

The walls of the land shafts are to be built in monolithic lifts encircling the entire shaft with joints as nearly as practicable in the positions shown on the contract drawings. In general, the minimum depth of one lift will be ten (10) feet and sufficient plant must be provided to mix and place in the forms at least sixty (60) cubic yards of concrete per hour.

Measuring.

Measuring boxes shall be of approved form and dimensions with the top area as small as practicable. A struck measurement will be required. Suitable means shall be provided for definitely measuring and accurately controlling the volume of water for each batch. Measuring apparatus for both aggregate and water shall be as nearly automatic as practicable. Wheelbarrow or other approximate measurements will in no case be permitted.

Receptacles to
be tight.

27-9. Cars, buckets and other receptacles used for transporting concrete shall be tight and shall be of an

SPECIFICATIONS—CONCRETE.

approved pattern. The method of transporting concrete from the mixer to the forms shall be approved by the Engineer.

27-10. Any concrete that takes its initial set before being placed in the work shall be at once rejected and removed. No retempering will be allowed under any conditions.

No retemper-
ing.

27-11. Rock surfaces against which concrete is to be placed shall be thoroughly cleaned, by washing with a strong stream of water or air, or both, if required, before forms for the concrete are placed, and recleaned if necessary before concreting starts. Earth surfaces shall be wet and compacted by ramming immediately before concrete is deposited upon them.

Preparing rock
and earth
surfaces.

27-12. Care must be taken that no water shall interfere with the proper placing of concrete. Water shall be prevented from entering any excavation at a point where concrete is being placed or while it is setting; or whenever this is not practicable, the water shall be conducted away from the concrete by means of sheet metal shields or pans connected with drains or weepers, all of which shall be grouted, if required by the Engineer, after the concrete is set. No concrete shall be deposited under water without the permission of the Engineer, and then only in strict accordance with his directions.

Water not to
interfere with
placing.

Before the concrete lining of the tunnel is placed, the tunnel lining shall be thoroughly cleaned with wire brushes and with water under nozzle pressure or by other approved means. This includes the removal of any grout which may adhere to the tunnel lining, and any foreign material in the caulking recess.

Tunnel
lining to be
cleaned.

SPECIFICATIONS—CONCRETE.

Depositing
concrete.

27-13. Concrete shall be placed in the forms as soon as possible after mixing, in such quantities and in such sequence of operations as will insure the plastic condition of the upper portion of the mass throughout the entire concreting of the form. As directed by the Engineer, the concrete shall be thoroughly compacted throughout the mass by spading or hammering the forms, special spading bars or tools being used as approved by the Engineer. Air hammering of the forms may be required in placing the protection concrete on the outside of the river shaft caissons.

Reinforcement
to be kept
in place.

27-14. Where reinforcing steel or wire mesh is used, satisfactory wiring or other means of support shall be provided to maintain it in the exact position it is to occupy in the completed work and to prevent it from becoming dislodged or moved in any manner when concrete is being placed.

Forms.

27-15. Suitable, clean, tight forms, substantially braced, shall be provided by the Contractor to support the concrete until it is set. If wood forms are used, the lagging shall be kept carefully planed and shall have tight joints. If required by the Engineer, the joints shall be either tongued and grooved or lapped. If metal forms are used, they shall be sufficiently strong to retain their shape without the use of wood backing. The use of wood forms covered with sheet metal will not be permitted. Whenever any form begins to lose its proper shape it shall be removed immediately from the work and replaced with a new one.

SPECIFICATIONS—CONCRETE.

27-16. Forms shall be set in the required position and so maintained by means of centering or other supports sufficiently firm to prevent any deflection. All joints and bulkheads shall be tight against leakage of mortar or water from the concrete. The surfaces of forms used repeatedly shall be cleaned of all cement and dirt before concrete is placed. Satisfactory measures shall be taken to prevent the adhesion of mortar to the forms. If tie rods are used in connection with the forms for the land shaft caissons (wire ties will not be permitted), they shall be left in the concrete and so connected at the ends that the end of the rod is left two (2) inches back from the face of the concrete and the hole thoroughly packed with mortar. No extra payment will be made for such rods, but payment is deemed to be included in the price stipulated in the Schedule for concrete. Forms for placing the protection concrete around the river shafts shall be supported without the use of ties of any kind through the concrete itself. Tunnel forms shall be so placed and supported as to avoid unnecessary obstructions to the passage of men and materials through the work.

Setting and supporting forms.

27-17. Every precaution shall be taken to place or assemble the forms in such manner that when the forms are removed, after the concrete has been placed, the surfaces of the concrete that are to remain exposed shall be smooth and even, and free from offsets at the junction with preceding work.

Exposed surfaces to be smooth.

27-18. Concrete surfaces to which waterproofing is to be applied shall be made smooth at the time of placing and shall be carefully protected from injury until thoroughly set.

Surfaces smooth for waterproofing.

27-19. Wherever a section of concrete is left unfinished, leaving a surface which will be hard set before

Joints with new work.

SPECIFICATIONS—CONCRETE.

additional concrete can be joined to it, such dovetails, grooves or other bonds shall be provided as may be necessary to insure a good bond with the new work; and if deemed necessary by the Engineer, the joints shall be reinforced with steel bars or dowels to be furnished by the Contractor without additional payment.

In the horizontal joints of the land shaft walls and around the steel bulkheads, water stops, consisting of a steel plate covered with protective waterproof coating, shall be provided and placed, as shown on Contract Drawing No. 17. Payment for such stops will be made at the price stipulated in Schedule Item 71.

Joints cleaned.

27-20. In joints between old and new work the old surfaces shall be thoroughly cleaned by air blast or water under nozzle pressure, or both, or chiseled to remove laitance, as required by the Engineer, and such surfaces shall be wet and a neat cement wash applied, if required, immediately before placing the concrete. The payment for such work is deemed to be included in the price stipulated in the Schedule for concrete.

Mortar.

27-21. In starting the work of concreting or during the progress of the work, when in the judgment of the Engineer there is need of mortar batches (without stone) in order to avoid stone pockets in the finished work, such batches proportioned with cement and sand, as directed, shall be furnished by the Contractor, payment for which will be made per barrel of cement used. The volume of mortar so placed will be deducted from the payment volume of concrete. In estimating the volume of mortar so deducted the following equivalents will be used: 1 to 1 mortar will be computed as displacing 0.20 cubic yard of concrete per barrel of cement used; 1 to 2 mortar will be computed as displacing 0.30 cubic yard of concrete per barrel of cement used. This does not apply to mortar

SPECIFICATIONS—CONCRETE.

coatings placed on the surface of concrete to obtain a smooth finished surface or any other use of mortar other than that specifically stated in this Section.

27-22. The forms shall be removed as soon after the concrete has been placed as in the judgment of the Engineer may be done with safety to the work. Directions as to the time of the removal of forms shall be strictly followed and this work shall be done with care so as to avoid injury to the concrete. Immediately upon the removal of the forms the surfaces of the concrete shall be carefully examined and any irregularities of the surface shall be corrected as directed by the Engineer. Portions of the concrete around voids shall be cut out to the fullness of such defects and the space refilled with concrete or mortar in such proportions and in such manner as the Engineer may direct, at the Contractor's expense. Plastering will not be permitted.

Removal of
forms.

27-23. The surface of the concrete that will remain exposed in the tunnel roadway, air ducts and shafts shall be a finished surface of smooth and even character. As soon as the forms are removed, any irregularities in the surface shall be rubbed and re-rubbed in a manner approved by the Engineer, so as to obtain a uniformly smooth and even finish. All forms must be so placed as to avoid offsets at the junctions of sections poured at different times. If steel forms are used, the plates shall be so set as to produce a smooth even surface free from ridges or fins. Any finished surface, whether obtained by the use of steel forms or otherwise, shall be left equal to the smoothest sidewalk finish and shall be screeded, rubbed or floated, if necessary, until such a surface is obtained. Wherever special finish is to be applied on this contract or under other contracts, as shown on the

Tunnel concrete
and surface
finish.

SPECIFICATIONS—CONCRETE.

contract drawings, the concrete shall be given a rough surface obtained by roughening or scoring the concrete in an approved manner to provide a proper bond for such finish. All corners in exposed situations, sidewalks, inverts and other surfaces likely to become injured shall be kept suitably covered and protected.

Concrete inverts of caissons.

The concrete in the arched inverts of the shaft caissons shall be placed as far as practicable as a monolithic mass. If, in the judgment of the Engineer, it is impossible to place the entire invert in one pouring, the sections and bulkheads shall be so arranged as not to impair the strength of the concrete arch.

Concrete roofs of land shafts.

The concrete roofs of the land shaft caissons will be included in caisson concrete placed in normal air and will be estimated for payment under Schedule Item 27 (b).

Protection concrete outside river shaft caissons.

Protection concrete around the upper part of the river shaft caissons shall be placed in such a manner as to insure its being water-tight. The concrete shall be placed in a continuous ring around the caissons and special care shall be taken to make the horizontal joints between different sections water-tight. The concrete backing of the granite facing shall be placed as provided for in Sections 35-3 and 35-6. In addition to the provisions otherwise herein provided, special provisions shall be made to prevent injury to the concrete, or granite facing in the process of sinking.

Concrete cradle.

Concrete for cradle to carry the shields, as provided in Section 8-5, shall be placed throughout the rock section. Payment for this item shall include furnishing and placing steel rails or plates embedded in the concrete upon which to slide the shields.

Precautions in freezing weather.

27-24. During freezing weather, the Contractor shall take all necessary precautions to prevent injury to concrete by frost. The Contractor shall heat with suitable apparatus the sand, stone and water before placing them

SPECIFICATIONS—CONCRETE.

in the mixer and all materials shall enter the mixer free from frost and ice. Concrete shall not be placed on or next to frozen surfaces. If metal forms are used satisfactory means shall be employed to keep concrete placed against them from becoming frozen. During freezing weather concrete shall be protected, as soon as placed, by a suitable covering of hay, canvas or tarpaulin, or in such other manner as may be required to insure it against freezing; and concrete shall not be placed in exposed places where the Engineer considers it impracticable to give such protection.

27-25. During hot weather, concrete shall be kept moist by sprinkling and properly covered until it becomes thoroughly set and hardened.

Precautions in hot weather.

27-26. It is intended that the concrete shall be water-tight; and the Contractor will be required to exercise every care in mixing, placing, spading and all other operations connected with this work, so as to provide a permanent water-tight structure. If leaks appear on the surface of the concrete at any time after it is set the Contractor shall, as directed by the Engineer, either remove the concrete through which the leakage takes place, stop the leak, repair the waterproofing and refill the hole with sound concrete or take such other steps as the Engineer may consider practicable to secure water-tightness.

Concrete to be water-tight.

In placing the concrete lining in the arch which forms the roof of the upper air duct of the tunnel, the Contractor shall, if required by the Engineer, place approved grout and vent pipes in each segment and key, and shall fill the voids between the tunnel lining and the concrete with Portland cement grout. No specific payment will be made for placing these pipes and grouting but payment therefor is deemed to be included in the unit prices stipulated in the Schedule for concrete.

Concrete to be grouted.

SPECIFICATIONS--CONCRETE.

Concrete in
compressed air.

No concrete shall be placed in compressed air when in the opinion of the Engineer it is practicable to avoid so doing.

Measurement
and payment,
concrete.

27-27. Concrete will be measured in place in the work to the net lines of the sections ordered and indicated on the drawings; and no additional allowance by way of measurement will be made, nor other method of measuring used, except that concrete extended to the limits of excavation in ledge rock where such excavations are made from the surface will be measured as extending to the payment lines described for such excavations in ledge rock in Section 1-7, and except that concrete in shield cradles in rock excavation as described in Section 8-5, will be estimated as of the volume actually placed and such volume may be determined by the Engineer from proportions of the ingredients and the quantity of the concrete used and except where the payment volume of concrete is increased due to a richer mixture as provided in Section 27-5 and except where the payment volume of concrete is decreased due to mortar batches being used as provided in Section 27-21. No deduction will be made for space occupied by unexcavated materials or timbering left within the payment lines and outside the net lines of the sections ordered and indicated on the drawings; and no concrete outside of such net lines, except as above in this Section provided, will be included in the measurement for payment. In measuring the volume of concrete, the space occupied by all embedded material such as ducts, pipes, steel and iron, will be deducted from the concrete, but the space occupied by reinforcing rods and bars, wire mesh, pipes less than two (2) inches in outside diameter, and tie rods, with their nuts, sleeve nuts, turnbuckles, clevises, bolts and pins (but not their structural steel anchorages) will not be deducted.

Payment for concrete will be at the price stipulated in Schedule Item 27 for all concrete not placed in com-

SPECIFICATIONS—GRANITE FACING.

pressed air, or in Schedule Item 28 for concrete placed in compressed air, for the volume of concrete measured as hereinbefore provided; and such payment shall be in full compensation for all concrete, whether within or without the payment lines, and for all expense in connection therewith or incidental thereto, it being understood that allowance is included in such stipulated price for all concrete in excess of that limited by the payment lines, for all ingredients, forms, scaffolding, centering, shields or pans with drains or weepers, troweling, screeding, rubbing, floating, securing water-tightness, except by grouting, cleaning the tunnel lining as provided in Section 27-12, and all other things required in and for mixing, placing and finishing the concrete.

Payment for mortar batches will be at the price stipulated in Schedule Item 29, which price shall be in full compensation for furnishing, mixing and placing such batches, and for all expense in connection therewith or incidental thereto.

ITEM 35—GRANITE FACING ON THE OUTSIDE OF THE RIVER SHAFT CAISSONS.

35-1. All granite shall be medium grained, show an even distribution of constituent minerals, have a uniform appearance and quality, a dense granular texture, and be practically free from mica, without seams, scales or other discolorations showing disintegration. It shall be a true granite; gneiss rock will not be permitted. All granite furnished shall be sufficiently hard to withstand a crushing stress of 20,000 lbs. per square inch when made in four (4) inch cubes.

Granite.

35-2. Before placing an order for granite, the Contractor shall furnish the Engineer with samples and test cubes for his approval, and after such approval, all granite

Contractor to furnish Engineer with samples.

SPECIFICATIONS—GRANITE FACING.

must comply with these samples and with the plans and specifications.

Cutting and
placing.

35-3. Granite for facing shall be of the dimensions shown on the contract drawings and shall be cut and placed as follows: all stone shall be dressed for laying in natural bed, and such beds shall be well dressed, parallel and true to the proper line. The beds, joints and tops of the stone must be cut square with each other, fine pointed and dressed true and out of wind, before being placed on the work so as to form joints not less than one-quarter ($\frac{1}{4}$) inch nor more than one-half ($\frac{1}{2}$) inch in thickness, and joints shall be full to the square for a depth of at least four (4) inches.

The headers shall have their beds beyond the line of the stretchers cut with a slope so that when concrete is poured back of the wall no air pockets will be left underneath. All headers back of the line of the stretchers shall be wedge shaped in plan, the wider end at the rear.

The exposed surface of each stone shall be rock faced and the edges pitched to true lines, the face to have no projections over one (1) inch beyond the pitch lines.

Mortar.

35-4. Mortar for laying granite facing shall consist of Portland cement and sand or other fine aggregate in a proportion of 1 to 1. The sand and cement shall be mixed dry and in small batches to which water shall be added and the whole remixed until the mass is thoroughly homogeneous. It shall not be retempered after it has begun to set.

Laying.

35-5. The facing shall be Ashlar masonry with alternate headers and stretchers as shown on Contract Drawing No. 29.

SPECIFICATIONS—GRANITE FACING.

All stone shall be settled in place in a full bed of mortar. No stone shall be dropped into position but shall be placed without jarring the stone already laid. No heavy hammering shall be allowed on the wall after the course is laid. If any stone becomes loose after the mortar is set it shall be relaid with fresh mortar. Each stone shall be cleaned and dampened before laying. No work shall be done in freezing weather unless with the permission of the Engineer and in accordance with his directions. Courses shall be laid to exact lines and levels so as to give required bond and thickness of mortar in beds and joints.

35-6. The concrete backing, as specified in Section 27-23 will be poured after the placing of the granite facing as determined by the Engineer. Every precaution shall be taken to make the joints between the granite facing and the concrete backing water-tight.

Concrete
backing.

35-7. Mortar in beds and joints of exposed faces shall be removed to a depth of not less than one (1) inch before it has set. The joints shall later be filled with mortar, pounded with caulking tools and finished in a neat manner.

Pointing.

35-8. Measurements for payment for granite facing will be of the actual volume of granite in place on the work to the net lines of the sections ordered and indicated on the drawings. In measuring the volume of granite all imbedded material and mortar will be included.

Measurement
and payment,
granite facing.

Payment for granite facing will be at the price stipulated in Schedule Item 35 for the volume measured as

SPECIFICATIONS—GRANITE CURBING.

hereinbefore provided, which price shall be in full compensation for the furnishing and placing of all granite complete, and all expense in connection therewith or incidental thereto, including all cutting, dressing, mortar and the furnishing of all scaffolding and forms.

Payment for concrete backing will be at the price stipulated in Schedule 27 (c).

ITEM 36—GRANITE CURBING.

Granite
curbing.

36-1. All granite for curbing and slabs shall be furnished in accordance with the provisions of Sections 35-1 and 35-2.

Cutting of
curbing and
slabs.

36-2. All curbstones and slabs shall be faced to a line one (1) inch below the surface of the pavement and cut on a bevel of one-quarter ($\frac{1}{4}$) inch in eight (8) inches. All tops shall be cut on a slope of one-quarter ($\frac{1}{4}$) inch in twelve (12) inches. The bottom of the slabs shall be cut to a slope of one-half ($\frac{1}{2}$) inch in five (5) inches, and both the top and the face of all stones shall be dressed to a surface equal to four cut work; the arris formed by the top and face shall be rounded off to a one-half ($\frac{1}{2}$) inch radius. The stones shall be out of wind and have no depressions greater than one-quarter ($\frac{1}{4}$) inch measured from a line or straight edge of the same length as the stone where dressed; the remainder of the face shall be free from projections of not more than one-half ($\frac{1}{2}$) inch. The back of the curbing shall be faced one (1) inch down from the top and shall be parallel to the front and have no projections greater than one-half ($\frac{1}{2}$) inch, except that the back of all curbing along the gutter

SPECIFICATIONS—GRANITE CURBING.

drain shall be dressed to a surface equal to four cut work. The bottom of the curb shall be rough squared.

The ends of the stones for their full width shall be close-jointed four (4) inches down from the top and from this point to a point twelve (12) inches from the top they shall be close-jointed one (1) inch in from the face. They shall be square to top and face with no depressions greater than three-eighths ($\frac{3}{8}$) inch; the remainder of the end shall be cut so that there shall be a fairly close joint.

End joints.

The curbing and slabs shall be set with close joints and to line and grade as given by the Engineer, so that the front edge at the top shall present a fair and unbroken line and the face a plain surface with a batter of one-quarter ($\frac{1}{4}$) inch in eight (8) inches. The foundation and backing for the curb shall be concrete as specified in Sections 27-1 to 27-27, inclusive, and as shown on Contract Drawing No. 4.

Setting of
curbing and
slabs.

No curbstone of a length less than four and one-half ($4\frac{1}{2}$) feet will be accepted. All stone shall be cut to the dimensions indicated on the contract drawings. Granite slabs over the inlet openings shall be cut and placed as shown on these drawings.

36-3. Measurements for payment for granite curbing and slabs will be of the actual number of lineal feet placed in the work without any allowance for laps or dowels, or deductions for gutter inlet openings, and payment will be made at the price stipulated in Schedule Item 36, which price shall be in full compensation for furnishing and laying all granite curbing and slabs complete, and all expense in connection therewith or incidental thereto, including the dressing, cutting and fitting of the same.

Measurement
and payment,
granite curbing
and slabs.

SPECIFICATIONS—GROUT.

Concrete in foundations and backing will be measured as provided in Section 27-27, and paid for at the price stipulated in Schedule Item 27 (d).

Anchor bolts will be measured as provided in Section 70-50, and paid for at the price stipulated in Schedule Item 70.

ITEM 45—GROUT.

Where used.	45-1. Grouting will be done to fill voids behind concrete lining or tunnel lining, to fill voids outside the caissons when in final position and for other purposes as required by the Engineer. Grout shall be composed either of a 1 to 1 mixture, by volume, of cement and sand, mixed with clean, fresh water, or of a 1 to 0 mixture (neat cement grout), as required by the Engineer.
Composition.	For purposes of defining the mixture and for payment three hundred seventy-six (376) pounds of Portland cement or two hundred eighty-two (282) pounds of natural cement shall be estimated at three and five-tenths (3.5) cubic feet of volume and will be considered a barrel. The proportional volume of sand shall be as cast into the measuring box.
Proportions.	
Sand.	45-2. Sand for grout shall be of the quality specified for concrete, but of such fineness that it will all pass a sieve having sixty-four (64) openings per square inch. For special purposes finer sand may be required.
Methods of grouting.	45-3. Voids outside the tunnel lining shall be wholly or partially filled with grout as hereinafter more particularly specified. Grouting shall be commenced at the bottom of a ring or section and shall proceed uniformly upward unless some other order of grouting is directed. Each plug shall be removed and the

SPECIFICATIONS—GROUT.

grout mixing machine connected to the grouting hole by means of a hose and a nipple cut to the same thread as the screw plug. The machine used shall be of a type which will mix the grout continuously until discharged from the mixer and permit the application of a pressure of sixty (60) pounds per square inch in excess of the external water pressure. Care shall be taken not to continue the excess air pressure after the grout is discharged from the mixer. When the grouting through any hole is completed, the threads of both hole and plug shall be cleaned, the plug replaced in the hole and screwed tight.

45-4. Where the tunnel lining is erected in rock, the voids outside the lining shall be filled with grout containing mixed cement and sand, except where Portland cement is ordered. Grout forced through the lower holes of the lining must show at the upper holes before connection is made to the latter for grouting. The Contractor shall place such pipes in the upper holes or elsewhere as the Engineer may require to determine the extent or progress of the grouting, and to serve as vents.

Grouting
in rock.

45-5. Grout ejected through the tunnel lining in earth shall contain mixed cement except where Portland cement is ordered. Where the excavation is wholly or partly in rock, or in hard pan or other material firm enough to keep its form after the shield passes until grouted, enough grout shall be used to fill the voids between the tunnel lining and the undisturbed material, but only the volume of grout used to fill the space limited by the excavation payment line will be paid for. Where the excavation is in sand or other moving material, actual voids around the lower three-fourths ($\frac{3}{4}$) of the tunnel shall be filled with grout, but the upper one-fourth ($\frac{1}{4}$) shall not be grouted, except as provided in Sections 45-6

Grouting in
earth through
tunnel lining.

SPECIFICATIONS—GROUT.

and 45-7. In all the cases described in this Section and in Section 45-6, the grouting shall follow erection of lining as closely as the Engineer deems practicable, and effective means must be employed to confine the grout in sections and to prevent its return into the shield.

Grouting
adjacent to
buildings.

45-6. Where the tunnel is adjacent to buildings, or other structures on the landward side of the river bulkhead, all voids around and above the tunnel lining shall be filled with grout.

Additional
grouting at
contractor's
expense.

45-7. The Contractor will be permitted to eject additional grout through the tunnel lining or in the face of the heading or elsewhere as he may deem advantageous to himself in the prosecution of his work; but no specific payment will be made therefor, and compensation for such grouting is deemed to be included in the unit prices stipulated in the Schedule for tunnel excavation.

Measurement
and payment,
grouting.

45-8. Grouting will be estimated for payment on the basis of the number of barrels of cement actually used in grout and placed in the work according to the directions of the Engineer. Grouting in the tunnel will be estimated for payment on the basis of the number of barrels of cement actually used in grout ejected through the tunnel lining as required and as limited in Sections 45-4, 45-5, and 45-6. If, through inefficient packing between the tail of the shield and the tunnel lining, grout is permitted to flow into the shield or tunnel, or if it is permitted to flow around the shield or otherwise wasted, the amount thus wasted, as determined by the Engineer, will not be estimated for payment. Grouting done within the upper one-fourth ($\frac{1}{4}$) of the circumference of the tunnel, where the excavation is in sand or other moving material, except

SPECIFICATIONS—PILING AND TIMBERING.

near buildings as required in Section 45-6, and grouting done by the Contractor for his own advantage as described in Section 45-7, will not be estimated for payment.

Payment for grouting, measured as provided above in this Section, will be at the price stipulated in Schedule Item 45 or 47 for 1 to 1 Portland cement grout and Item 46 or 48 for 1 to 0 Portland cement grout (neat grout), or Schedule Item 49 for 1 to 1 mixed cement grout and Item 50 for 1 to 0 mixed cement grout (neat grout). These prices shall be in full compensation for grouting complete, and all expense in connection therewith or incidental thereto, including drilling holes, furnishing and placing pipes, supplying sand and other materials and making grouting connections, grouting and replacing grout plugs.

Payment for mixed cement grout will include payment for Portland cement and payment for natural cement as provided in the Schedule, the mixture to be proportioned as defined in Section 25-12.

ITEMS 52-59—PILING AND TIMBERING.

RIVER SHAFT PILES.

52-1. Reinforced concrete piles, as shown on Contract Drawing No. 29, shall be driven to support the river shaft caissons. Concrete piles twenty-four (24) inches in diameter with a steel shell three-eighths ($\frac{3}{8}$) inch in thickness with reinforcing rods and hoops similar to those shown on the drawing mentioned above may be required.

Reinforced
concrete piles.

52-2. Prior to driving the piles, the Contractor shall submit to the Engineer, for his approval, detailed plans

SPECIFICATIONS—PILING AND TIMBERING.

of the methods he proposes to use for this work. The piles shall be driven to firm bearing and when in final position shall support the entire load of the shafts. Connection shall be made to the caisson inverts or walls of the shafts, as shown on Contract Drawing No. 29.

52-3. In driving and concreting such piles, the Contractor shall use every precaution to keep the piles in a vertical position, to prevent all leakage through the joints of the steel shell, to maintain the reinforcing in proper position, to mix and place the concrete without interference from water and with proper construction joints, and to protect the reinforced concrete and the pile casing from damage. The Contractor shall use every precaution to see that there is no danger of flooding the caissons or loosening the ground underneath or alongside thereof.

Measurement
and payment,
reinforced
concrete piles.

52-4. Measurement for payment for furnishing and driving reinforced concrete piles to support the river shaft caissons in final position will be of the actual length driven from the point of the pile to the top of the pile in its final position, as shown on the contract drawings.

Payment for furnishing and driving reinforced concrete piles will be made at the price stipulated in Schedule Item 54, which price shall be in full compensation for furnishing and placing the piles complete and all expense in connection therewith or incidental thereto, including the use of all machinery or other appliances necessary to drive such piles, tools, compressed air and the removal and disposal of material.

No payment will be made for piles not properly driven or not being in the proper place, as indicated on the contract drawings.

SPECIFICATIONS—PILING AND TIMBERING.

PILES TO SUPPORT TUNNEL.

52-5. Piles shall be driven through the bottom of the tunnel lining if required by the Engineer.

Piles to support tunnel.

52-6. Piles driven through the tunnel lining will be paid for as provided in Schedule Item 300, except that special machinery not otherwise used on the Works will be paid for on a rental basis as determined by the Engineer, and if piles be driven in the tunnel under compressed air a reasonable allowance, to be determined by the Engineer, will be made to the Contractor for the power required to supply the compressed air to the tunnel whenever it is necessary to keep the tunnel under pressure solely on account of driving such piles.

Measurement and payment, piles to support tunnel.

SHAFT PLATFORM.

52-7. At the completion of the river shaft work the Contractor shall remove the shaft platform, including the supporting piles and dispose of such material, except such parts as the Engineer may require to be left. That part of the platform left in place shall have all bracing securely fastened and the flooring left in a satisfactory condition.

Shaft platform to be removed.

52-8. Measurement for payment for the platform left in place will be of the floor area and will include only such parts of the platform erected by the Contractor as the Engineer may require to be left.

Measurement and payment, platform left in place.

Payment for the platform measured as above provided will be at the price stipulated in Schedule Item 57, which price shall be in full compensation for this platform complete and all expense in connection therewith or incidental thereto, including all repairs necessary to put it in a serviceable condition.

SPECIFICATIONS—PILING AND TIMBERING.

LAND SHAFT BULKHEADS.

Openings in
walls, land
shaft caisson.

52-9. Openings in the walls of the land shaft caissons for future connection with air ducts are to be closed with timber bulkheads, details of which are shown on the contract drawings.

Timber.

52-10. Timber in such bulkheads shall be hard yellow pine or other acceptable timber and shall be sound and free from knots, checks or other defects that might impair its strength or water-tightness.

Joints, timber
bulkheads.

52-11. All joints in such timber bulkheads shall be caulked with oakum dipped in hot asphalt and made water-tight, after the bulkhead is concreted into place.

Lagging to be
fastened.

52-12. The lagging shall be fastened to the cleats by lag screws of such size and spacing as the Engineer may direct. The ends and sides of the bulkheads shall be coated with asphalt mastic before being imbedded in the concrete.

Cement
mortar.

52-13. The inside surfaces of the bulkheads shall be coated with a cement mortar placed on wire mesh fastened to the bulkheads, after the caissons are sunk to place. Immediately before plastering, any leaks which have developed shall be stopped by caulking.

Measurement
and payment,
timber bulk-
heads.

52-14. Measurement for payment for timber bulkheads will be of the actual quantity of timber placed, without allowance for waste, but no deductions will be made on account of tenons, mortises or oblique cuts.

SPECIFICATIONS—WATERPROOFING.

Payment for timber bulkheads will be at the price stipulated in Schedule Item 59, which price shall be in full compensation for furnishing and placing the timber bulkheads complete, and all expense in connection therewith or incidental thereto, including the asphalt coating, caulking, re-caulking, furnishing and placing wire mesh and plastering.

ITEMS 60-66—WATERPROOFING.

60-1. Waterproofing consisting of one or more plies of waterproofing fabric laid with asphalt, will be required to be applied to parts of the structure where dependence is not placed on the concrete or on the tunnel lining or other parts of the structure to act as waterproofing. The number of plies of fabric shall be as indicated on the drawings or as directed by the Engineer. All waterproofing so laid shall be made absolutely watertight.

Where used.

60-2. Waterproofing fabric shall be a good grade of woven cotton treated before being brought on the work with asphalt meeting the requirements hereinafter specified. The fabric in its raw or untreated state shall contain no oils of any kind. It shall weigh not less than 4 oz. nor more than six (6) oz. per square yard and its thread count shall not be more than thirty-two (32) by thirty-two (32) per square inch. The fabric after treatment shall weigh not less than three (3) times the weight of the untreated fabric, shall have a stretch of at least ten per centum (10%), in either direction, and the tensile strength in either direction shall be not less than fifty (50) pounds when tested by Strip Method No. 1, adopted 1920 by the American Society for Testing Materials.

Woven cotton fabric.

The fabric and all materials used in its treatment shall be of a kind and quality approved by the Engineer. By

SPECIFICATIONS—WATERPROOFING.

the term "ply" is meant a layer of such treated fabric together with its coating of asphalt placed on each side at the time of laying.

Asphalt.

60-3. Asphalt shall be fluxed natural asphalt or asphalt prepared from the careful distillation of asphaltic petroleum. It shall be delivered on the work in barrels or other suitable containers plainly marked with the manufacturer's name and indicating the kind, grade and quality of the material.

Fluxes used with a natural asphalt shall be of such character that they will combine with the natural asphalt to form an acceptable and approved asphaltic cement.

The asphalt shall be free from coal tar pitch or any of its products. It shall have a melting point between 150° and 175° F. as determined by the Ball-in-Ring method and shall not flash below 400° F., when tested in a New York State Closed Oil Tester.

The consistency at different temperatures (including 35° F.), as determined by the penetration of a No. 2 cambric needle weighted and applied in accordance with the methods adopted by the American Society for Testing Materials, and the ductility, as determined by the Dow method, shall meet the approval of the Engineer.

The asphalt shall contain not less than ninety-five per centum (95%) of bitumen soluble in cold carbon disulphide, and not less than ninety-eight and one-half per centum (98½%) of such bitumen shall be soluble in cold carbon tetrachloride. The remaining ingredients shall be non-injurious.

The specific gravity of the asphalt shall be not less than 1.0 at 77° F., and the asphalt shall not volatilize more than two per centum (2%) when heated for five (5) hours at 325° F., after which the penetration at 77° F. shall be not less than one-half (½) of the original penetration.

If required by the Engineer the asphalt must

SPECIFICATIONS—WATERPROOFING.

withstand a test of immersion for seventy-two (72) hours or longer, in a twenty-five per centum (25%) solution of sulphuric acid without deterioration.

The requirements for asphalt shall apply alike to that used in saturating the fabric and that used in cementing the layers of fabric together on the work.

60-4. Bricks used for waterproofing protection shall be of the best quality common bricks burned hard throughout, regular and uniform in shape and size and of compact texture. In laying, the bricks shall be completely imbedded in 1 to 1 cement mortar under the bottom and on the sides and ends at one operation, care being taken to have every joint full of mortar.

Brick.

60-5. Waterproofing material on the outside of the river shaft caissons and on the steel water stops in the land shaft caissons will be furnished as provided in Section 60-14. The steelwork shall be thoroughly cleaned and a layer of waterproofing material, at least one-sixteenth (1/16) inch in thickness, shall be applied. If necessary to secure adhesion, the steel of the caissons or the steel of the water stops shall be heated.

Protective
waterproof
coating.

60-6. The earth or rock in the bottom of the chamber of the shaft caissons shall be covered with a layer of concrete six (6) inches in thickness, as shown on the drawings, with a coating of mortar containing equal parts, by volume, of cement and sand, troweled smooth. This mortar coating will be paid for as concrete, under Schedule Item 28. Upon this coating, after it is dry, shall be spread a layer of asphalt having a uniform thickness of not less than one-sixteenth (1/16) inch, so as to form a complete covering without blow-holes. This asphalt shall have been previously heated to a temperature not exceed-

Waterproofing.
caisson inverts.

SPECIFICATIONS—WATERPROOFING.

ing 325° F. Upon this layer of asphalt, while it is still melted, there shall be pressed into complete contact with it a layer of waterproofing fabric, consisting of sheets overlapping not less than four (4) inches on the long edges and not less than twelve (12) inches at ends, with the laps laid in hot melted asphalt. Upon this layer of fabric there shall be spread a layer of asphalt as above specified, another layer of fabric added as above with laps to stagger with the laps of the previous layer of fabric; and the process shall be continued until four (4) or six (6) layers of fabric, as determined by the Engineer, have been laid, finishing with a layer of asphalt. Upon the waterproofing there shall be laid one course of brick, on the flat, in a bed of mortar one-half ($\frac{1}{2}$) inch thick, containing equal volumes of cement and sand and the joints of the bricks shall be completely filled with mortar of the same composition. Care shall be taken to secure the best obtainable seal between the waterproofing and the metal work of the caisson. Blow-pipes shall be so arranged as to remove fumes from any compressed air chamber at the point where the waterproofing is being applied.

Waterproofing
to be applied to
dry surface.

60-7. In waterproofing in normal air the water shall be controlled so that work can be done in the dry. In waterproofing in compressed air sufficient air pressure shall be maintained to prevent the percolation of water into the chamber.

Joints with
new work.

60-9. Where new waterproofing is joined to old, the surface of the old waterproofing at the junction shall be thoroughly cleaned and dried, shall be heated to soften the asphalt and shall be given a lap of at least eighteen (18) inches with the new waterproofing.

SPECIFICATIONS—WATERPROOFING.

60-10. Waterproofing shall be protected from injury after it is laid and during the placing of the masonry or protective covering against it. Any waterproofing damaged or found to leak shall be repaired or cut out and replaced at the sole expense of the Contractor. Exposed ends of waterproofing, if required, shall be temporarily protected with a covering of mortar or concrete without additional payment therefor.

Protection.

60-11. Air pressure balancing the hydrostatic head at the elevation of the waterproofing, or as required by the Engineer, shall be maintained in the land shaft caissons for a period of at least ten (10) days and in the river shaft caissons for a period of at least fourteen (14) days after the completion of the concrete invert above the waterproofing. After the expiration of the ten (10) or the fourteen (14) day period, as the case may be, the air pressure shall be gradually removed. If leakage appears, the Contractor shall make such repairs as will insure a permanent water-tight structure.

Removing air
from caissons.

60-12. In addition to the precautions against fire in compressed air as otherwise herein provided the utmost precautions shall be taken against fire in the caissons during the time that the asphalt waterproofing is exposed. No workman shall be allowed to use lighted candles or to carry matches into the compressed air chambers where waterproofing is exposed. Such quantities of sand as required by the Engineer shall be kept in the working chamber for use in case of fire.

Fire precau-
tions.

60-13. None but competent men, especially skilled in work of this kind, shall be employed to lay the waterproofing.

Skilled labor to
be employed.

SPECIFICATIONS—WATERPROOFING.

Measurement
and payment,
waterproofing.

60-14. Measurements for payment for ply waterproofing will be made only of the actual net area covered by the number of plies ordered, no account being taken of laps, it being understood that all excess materials, labor and other expense resulting from the requirements for laps have been estimated and provided for by the Contractor in the unit prices stipulated in the Schedule for waterproofing.

In normal air.

Payment for ply waterproofing not laid in compressed air, without protective layer of brick, will be at the price stipulated in Schedule Item 60, which price shall be in full compensation for furnishing and laying the waterproofing complete, and all expense in connection therewith or incidental thereto.

In compressed
air.

Payment for ply waterproofing laid in compressed air, including protective layer of brick, will be at the price stipulated in Schedule Item 64, which price shall be in full compensation for furnishing and laying the waterproofing complete, and all expense in connection therewith or incidental thereto, including filling the grooves around the edge of the caissons, and around the piles with asphalt, and testing.

Protective
waterproof
coating on
steel.

Payment for applying the protective waterproof coating on steel water-stops in the land shaft caissons and on the outside steel of the river shaft caissons will be at the price stipulated in Schedule Item 66 (a), which price shall be in full compensation for placing the waterproofing complete and all expense in connection therewith or incidental thereto, including heating and applying the materials, cleaning the steelwork and heating the latter, if required. The material to be applied will be furnished as provided in Schedule Item 300.

SPECIFICATIONS—WATERPROOFING.

60-15. As soon as practicable after the tunnel lining is erected it shall be made absolutely water-tight by caulking all recesses provided in the joints. When required by the Engineer, the air pressure shall be lowered or removed to test the effectiveness of the caulking and grommeting.

Tunnel lining
to be made
water-tight.

60-16. Joints shall be made water-tight by a continuous caulking of metallic lead in the caulking recesses. The lead must be as nearly as practicable of the same width as the width of the recess. Before the segments are erected, the rebates to form the caulking recess shall be scraped clean. Before caulking, the recesses must be thoroughly cleaned by means of an air jet or water jet under high pressure and, if required, by scraping. If leakage is found after caulking, the joint shall be recaulked until all leakage is stopped, the lead being removed and renewed if required. Before the concrete lining is placed and at such time as the Engineer permits, the caulking recesses, or the remaining portions thereof where lead caulking is used, shall be rammed full and pointed with Portland cement mortar mixed in the proportion of one (1) part cement to one (1) part sand. This mortar is considered a part of the caulking. Payment for caulking is included in the unit prices stipulated in Schedule Items 88 and 90 for tunnel lining.

Caulking.

60-17. Leakage around bolts shall be prevented by applying grommets under the washers at the head

Grommeting.

SPECIFICATIONS—STEEL AND WROUGHT IRON.

and nut of each bolt, at the time the segment is being erected. These grommets shall be made of hemp well worked up with a paste of red lead, or a mixture of red lead and white lead, and boiled linseed oil. Grommets of other material approved by the Engineer may be used. If leakage is found after grommeting, the bolts around which leakage occurs shall be removed and the grommeting renewed until the leakage is stopped. Immediately before the concrete lining in the tunnel is placed, the bolts will be given a final inspection and shall be re-grommeted until made absolutely water-tight. Payment for grommeting is included in the unit price stipulated in Schedule Item 76 (a), for tunnel bolts.

ITEMS 70-85—STEEL AND WROUGHT IRON.

According to drawings.

70-1. All steel and iron work shall be fabricated in all respects according to general and detailed drawings furnished or approved by the Engineer. The Contractor shall be responsible for all errors which can be discovered by checking or examining the drawings.

Workmanship.

70-2. The workmanship shall be equal to the best practice in modern bridge works. All parts exposed to view shall be neatly finished.

Facilities for inspection.

70-3. The Contractor shall furnish, free of charge, all facilities for a thorough inspection of material and workmanship, including suitably equipped offices at the mills and at the shops, prepared specimens for testing, the use of a reliable testing machine and necessary assistance for testing, certified chemical analyses of material, copies in triplicate of all mill orders, complete

SPECIFICATIONS—STEEL AND WROUGHT IRON.

copies in triplicate of all shipping invoices with each shipment showing the scale weight of each individual piece, and full access at all times for the Engineer and Inspectors to any part of the plant or plants where any portion of the material is made or worked.

70-4. No material shall be rolled nor work done without due notice to the Engineer so that he may arrange for inspection.

Notice for
inspection.

70-5. Material which, subsequent to tests at the mills and its acceptance there, develops weak spots, brittleness, cracks or other imperfections or is found to have injurious defects will be rejected at the shop and shall be replaced by the Contractor at his own cost.

Rejection
at shop.

70-6. The acceptance of any material or workmanship by an Inspector or his failure to notify the Contractor of defects in the same shall not prevent its subsequent rejection if found defective.

Rejection after
acceptance.

70-7. All parts shall be carefully loaded and protected from injury during transportation by such means as will be satisfactory to the Inspector. After delivery of materials at the work the Contractor will be required to store the same on skids at least twelve (12) inches above the ground and to keep the same in good condition. Any piece showing injurious effects of rough handling at any stage may be rejected.

Protection.

70-8. All steel and iron shall be protected from the weather before erection and shall be cleaned of all dirt, rust and scale before being painted, waterproofed or encased in concrete.

Protection
from weather.
Cleaned
before using.

SPECIFICATIONS—ROLLED STEEL.

ITEMS 70-76—ROLLED STEEL.

Open-hearth
process.

70-9. Steel shall be made by the open-hearth process.

Chemical
composition.

70-10. The chemical composition of the finished material shall conform to the following limits. Steel for plates, bars and shapes shall not contain more than $\frac{4}{100}$ of 1 per centum of phosphorus, $\frac{5}{100}$ of 1 per centum of sulphur, $\frac{6}{10}$ of 1 per centum of manganese, or $\frac{1}{10}$ of 1 per centum of silicon. Steel for rivets shall conform to the same limits, except that it shall not contain more than $\frac{4}{100}$ of 1 per centum of sulphur.

Chemical
determinations.

70-11. Chemical determinations of the percentages of carbon, phosphorus, sulphur and manganese shall be made by the manufacturer from a test ingot, so taken during the casting of each melt of steel as fairly to represent the melt. Two (2) copies of such analyses shall be furnished to the Engineer or his Inspector.

Material to
be sound.

70-12. By cropping ingots sufficient discard shall be made to insure sound material free from piping or excessive segregation. The material shall be finished straight and smooth and shall be free from all seams, flaws, cracks, defective edges or other defects. Any imperfection which may develop during the progress of the work will be sufficient cause for rejection.

Variation in
weight.

70-13. A variation in weight or cross section of any piece of steel of more than two and one-half per centum ($2\frac{1}{2}\%$) from that specified shall be sufficient cause for rejection, except in case of sheared plates exceeding one hundred (100) inches in width, where the variation may be five per centum (5%). In calculating weights of steel the weight of one (1) cubic foot will be taken at four hundred ninety (490) pounds.

SPECIFICATIONS—ROLLED STEEL.

70-14. Every finished piece of steel shall have the melt number and the name of the manufacturer stamped or rolled upon it. Bars for reinforcing concrete, rivet and lattice steel and other small parts may be bundled, with above marks on an attached metal tag.

Melt number.

70-15. Steel for plates, reinforcing rods, bars and shapes shall have an ultimate tensile strength of from 56,000 to 64,000 pounds per square inch, and steel for rivets shall have an ultimate tensile strength of from 46,000 to 54,000 pounds per square inch. All steel shall have a yield point at not less than fifty-five per centum (55%) of the ultimate tensile strength; a minimum percentage of elongation in eight (8) inches represented by the quotient of 1,500,000 divided by the ultimate tensile strength; shall exhibit a silky fracture; and shall be capable of being bent flat on itself when cold without sign of fracture.

Tensile and bending requirements.

Angles three-quarter ($\frac{3}{4}$) inch or less in thickness shall open flat, and angles one-half ($\frac{1}{2}$) inch or less in thickness shall bend shut, cold, under blows of a hammer, without sign of fracture. This test shall be made only when required by the Inspector.

Bending test for angles.

70-16. At least one tensile and one bending test shall be made on specimens cut from the finished material of each melt. In case steel differing three-eighths ($\frac{3}{8}$) inch or more in thickness is rolled from one melt, tests shall be made from the thickest and from the thinnest material rolled. Rolled steel shall be tested in the condition in which it comes from the rolls.

Number of tests.

70-17. Sample pieces for tensile and bending tests of plates, reinforcing rods, bars and shapes shall be cut from such portions of the finished product of each melt as the

Test pieces.

SPECIFICATIONS—ROLLED STEEL.

Inspector may designate and shall be stamped by him; they shall have both faces rolled and both edges milled to the usual form of a standard test specimen—one and one-half ($1\frac{1}{2}$) inches wide on a gauged length of nine (9) inches, or with both edges parallel. The area of the minimum section shall be not less than one-half ($\frac{1}{2}$) square inch.

Rivet rods.

70-18. Rivet rods shall be tested as rolled.

Yield points.

70-20. The yield point shall be that strain beyond which the elongation ceases to be proportional to the weight imposed and may be indicated by drop of beam. The speed of testing shall be governed by the Inspector.

Rivet steel
nicking tests.

70-21. Rivet steel, when nicked and bent around a bar of the same diameter as the rivet rod, shall give a gradual break and a fine, silky, uniform fracture.

Retests.

70-22. If the specimens tested as herein specified do not fulfill the requirements of these specifications, duplicate tests may be made at the discretion of the Inspector, who will select and stamp the duplicate test pieces. If these retests meet all requirements, the melt shall be accepted.

Wire mesh.

70-23. Wire mesh or a similar reinforcing material of a quality, type and weight to be approved by the Engineer shall be furnished and placed, as may be required.

Reinforcing
rods to be
deformed.

Rods and bars to be used for reinforcing concrete shall be deformed as approved by the Engineer; plain bars shall not be used.

Bent rods.

70-24. Bent rods shall be bent uniformly to a template in a machine or press approved by the Engineer. They

SPECIFICATIONS—ROLLED STEEL.

may be bent either at the shop or on the work. In special cases bending hot and annealing may be required.

70-25. Rods and bars which are to be upset to receive a thread will be so shown on the contract drawings.

Upset for threads.

70-26. Steel, except in minor details, which has been partially heated, shall be properly annealed. Welds in steel will be allowed only under conditions approved by the Engineer.

Annealing.

70-27. All material shall be straightened in the shop before being worked in any way and again straightened after punching and before assembling, if required by the Engineer or his Inspector.

Straightening.

70-28. Shearing and chipping shall be neatly and accurately done. Sheared edges of plates exceeding five-eighths ($\frac{5}{8}$) inch in thickness in main members shall be planed at least one-eighth ($\frac{1}{8}$) inch.

Shearing and chipping.

70-29. Lattice bars shall have neatly rounded ends concentric with rivet holes.

Lattice bars.

70-30. Nuts and heads of bolts exposed to view and of bolts in tunnel lining, in the tie-rod connections, door posts and lintels shall be hexagonal.

Bolt heads and nuts hexagonal.

70-31. All material up to a thickness of five-eighths ($\frac{5}{8}$) inch may be punched without reaming. Material over five-eighths ($\frac{5}{8}$) inch and not exceeding seven-eighths ($\frac{7}{8}$) inch in thickness shall be sub-punched and reamed or drilled from the solid. Material over seven-eighths ($\frac{7}{8}$) inch in thickness shall be drilled from the solid.

Punching, reaming and drilling.

SPECIFICATIONS—ROLLED STEEL.

Holes accurately spaced.

70-32. All holes shall be accurately spaced and punched. The diameter of the punch shall not be more than one-sixteenth ($1/16$) inch greater than the diameter of the rivet. The diameter of the die shall be as small as may be required to punch a clean hole.

Sub-punching and reaming.

70-33. When sub-punching and reaming are required, the punch used shall have a diameter not less than three-sixteenths ($3/16$) inch smaller than the rivet. Holes shall then be reamed to a diameter not more than one-sixteenth ($1/16$) inch larger than the normal diameter of the rivet. All reaming shall be done with twist drills after the material is assembled and firmly bolted together. The use of lubricants in reaming will not be allowed. No interchange of reamed parts will be permitted unless a reaming template is used.

Templates.

70-34. All holes for field rivets designed to carry full allowable stresses, except where there are less than six (6) rivets in a group, shall be sub-punched and accurately drilled to an iron template fitted with bushings, or reamed and match marked while the connecting parts are temporarily assembled in the shop. All such holes shall be so indicated on the shop drawings.

Reaming of holes for field rivets in the temporary roof plates of the caisson may be omitted if, in the opinion of the Engineer, such holes can be so punched as to insure the erection of the plates without drifting.

Burrs removed.

70-35. All burrs on rivet holes shall be removed.

Size of rivets.

70-36. The size of rivets called for on the drawings shall be understood to mean the actual size of the cold rivet before heating.

SPECIFICATIONS—ROLLED STEEL.

70-37. Holes of built-up members when assembled must come truly opposite so that the rivets can be inserted without the use of drift pins. If any hole must be enlarged to admit the rivet it shall be reamed. Poor matching of holes will be cause for rejection. Reaming after assembling.

70-38. Riveted members shall have all parts well pinned up and firmly drawn together with bolts well in advance of riveting. Surfaces to be in contact or inaccessible after assembling shall be painted. Assembling.

70-39. Rivets when driven shall completely fill the holes and shall be machine driven wherever possible. They shall have full concentric heads or they shall be countersunk when so required. Rivet heads shall not be flattened to less than one-half ($\frac{1}{2}$) the diameter of the rivet on the line of the shank, unless countersunk. Loose, burnt or otherwise defective rivets shall be cut out and replaced. In cutting out defective rivets, great care shall be taken not to injure the adjacent material and if necessary such rivets shall be drilled out. Riveting.

70-40. Distances from centers of rivets to edges of sheared plates shall not be less than $1\frac{1}{4}$ " for $\frac{3}{4}$ " rivets and $1\frac{3}{8}$ " for $\frac{7}{8}$ " rivets; distances from centers of rivets to rolled edges shall not be less than $1\frac{1}{8}$ " for $\frac{3}{4}$ " rivets and $1\frac{1}{4}$ " for $\frac{7}{8}$ " rivets. The minimum pitch for $\frac{3}{4}$ " rivets shall be $2\frac{1}{2}$ " and for $\frac{7}{8}$ " rivets $2\frac{7}{8}$ ". When material is sub-punched and reamed the pitch for $\frac{3}{4}$ " rivets may be made $2\frac{1}{4}$ " and for $\frac{7}{8}$ " rivets $2\frac{5}{8}$ ". Rivet spacing.

In the river shaft caissons rivet spacing in caulked work shall not exceed four (4) inches.

70-41. Generally the use of bolts in place of rivets will not be permitted, but when bolts are so permitted to Use of bolts in place of rivets.

SPECIFICATIONS—ROLLED STEEL.

be used the holes shall be reamed parallel and the bolts turned to a driving fit with the threads entirely outside of the holes. Where bolts are used in place of rivets, washers not less than one-quarter ($\frac{1}{4}$) inch thick shall be used under the nuts. Bolts must be thickly coated with red lead paint before insertion so as to seal the hole against moisture.

Finished
members to be
true.

70-42. Finished members shall be true and free from twists, bends or open joints.

Planing and
facing.

70-43. All abutting surfaces shall be accurately planed or faced wherever so noted on the drawings, or as required by the Engineer.

Caulking
caissons.

The exterior and interior walls of the shaft caissons, both sides of the central cross wall and the dividing walls, the bulkhead openings, the roof of the working chamber and all other places required by the Engineer shall be caulked to insure a water-tight structure. Round edges shall be machined or chipped for caulking.

River shaft
caisson shield
bulkheads to
be assembled
in the shop.

Each shield bulkhead of the river shaft caissons together with its circular drum girder and girder connections and all skin plates and trusses connecting to the same shall be assembled and fitted in the shop before shipment.

Girder details.

70-44. Stiffeners of plate girders shall be faced on the ends and brought to a true contact bearing with the flange angles. Web splice plates and fillers under stiffeners shall be cut to fit within one-eighth ($\frac{1}{8}$) inch of flange angles.

Web plates.

70-45. Web plates must not project beyond the flange angles nor be more than one-quarter ($\frac{1}{4}$) inch back of face of angles.

SPECIFICATIONS—ROLLED STEEL.

70-46. High tensile steel bolts for the joints of the tunnel lining and where otherwise required, shall be forged from the solid without welding, upset under the heads, and the threaded ends shall project at least one-eighth ($\frac{1}{8}$) inch outside the nuts when the latter are screwed up in place in the Tunnel. Heads of bolts shall be hexagonal and correctly formed, of the dimensions shown on the drawings, square with the shank, smooth and free from fins. Screw threads shall be U. S. Standard, full, even, smooth, properly filleted and may be either rolled or pressed.

High tensile
steel bolts.

Steel for tunnel bolts shall contain not more than four hundredths of one per centum (0.04%) of phosphorus nor more than four hundredths of one per centum (0.04%) of sulphur. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of carbon, manganese, phosphorus, sulphur or any other element affecting the physical properties of the metal. This analysis shall be made from drillings taken at least one-eighth ($\frac{1}{8}$) inch beneath the surface of a test ingot obtained during the pouring of the melt.

Chemical
composition.

High tensile steel bolts shall have an ultimate tensile strength of not less than 110,000 pounds per square inch, a yield point of not less than 85,000 pounds per square inch, an elongation in two (2) inches of not less than sixteen per centum (16%) and a reduction in area of not less than fifty per centum (50%).

Tensile tests.

Tests of the tensile properties of tunnel bolts shall be made by breaking full sized bolts from each heat treated lot, as required by the Engineer. If a bolt fails to meet the tensile requirements, additional bolts as required by the Engineer shall be tested and the entire lot of bolts from which the test bolts are selected will be rejected if the tests are not satisfactory to the Engineer. These

SPECIFICATIONS—ROLLED STEEL.

tests shall be made by the Contractor without expense to the Commissions.

Bend test.

Full sized bolts shall bend cold through 180° around a pin, the diameter of which is equal to the diameter of the bolt, without crack or flaw.

Report of tests.

Reports of chemical and physical tests shall be delivered to the Engineer or his representative.

Washers.

Each bolt shall have a close fitting wrought-iron or steel washer under the head and nut.

Nuts.

Nuts shall be hexagonal in form and correctly shaped to fit the bolts. They shall be capable of developing the full strength of the finished bolt up to the point of rupture. They may be either hot pressed or cold punched, but, in either case, the base of the nut must be given a smooth finished surface and be normal to the axis of the bolt so as to bear uniformly on the washer. Threads on nuts shall conform to the requirements specified for bolt threads.

Permanent
steel tie-rods.

70-47. Permanent steel tie-rods of the design shown on the drawings or any alternative design submitted by the Contractor and approved by the Engineer, with their bolts, pins, sleeve nuts, turnbuckles and clevises shall be placed in the tunnel lining, where required, before the removal of compressed air. The steel in these tie-rods and their connections, with the exception of the structural steel anchorages, shall conform to the specifications for high tensile steel bolts.

Special steel
structures.

Special steel structures shall consist of anchorages for connecting the permanent tie-rods to the tunnel lining, special rolled beams for the tunnel roadway and the connecting rings for joining the tunnel lining with the caissons. In addition to the special rolled beams placed by the Contractor in the tunnel roadway, he shall furnish other beams of this section for the roadway across the

SPECIFICATIONS—ROLLED STEEL.

shafts as shown on Contract Drawing No. 31. These beams shall be stored in the tunnels near the shafts.

70-48. Copper steel shall be used as shown on the contract drawings or as ordered by the Engineer. It shall contain not less than twenty-five hundredths of one per centum (0.25%) of copper and not more than six hundredths of one per centum (0.06%) of sulphur and shall further conform to the physical properties specified in Section 70-15.

Copper steel.

70-49. Nuts, bolts, rivets and other similar material shall be boxed or otherwise securely packed for shipment. The net weight shall be plainly marked upon every piece or package.

Steel bolts, etc., boxed and weighed.

70-50. Steelwork will be estimated for payment on the basis of the quantity actually placed in accordance with the drawings or orders to form a part of the completed work. Removable portions not forming a part of the completed work, such as air locks, roofs of the working chambers, roof bracing, bulkheads closing the shield openings of the shaft caissons and material and man shafts, will not be included in the weight for payment, it being understood that all such portions are considered plant. In case of steel rods or bars for reinforcing concrete no payment will be made for fastenings and only such laps as are placed according to the directions of the Engineer will be estimated for payment. Weight for payment will be the invoice weight of all steel entering into each structure, except such payment weight shall not exceed the theoretical weight of the structure as computed from the drawings by more than two and one-half per centum ($2\frac{1}{2}\%$). Payment for steelwork so estimated will be at the price stipulated in Schedule Item:

Measurement and payment, rolled steel-work.

SPECIFICATIONS—ROLLED STEEL.

70. For built-up steelwork, anchor bolts, bolts other than high tensile steel bolts, malleable iron, and such wrought iron, steel castings and forgings as are not specifically provided to be paid for at or in other classified unit prices, including steelwork in the splicing chambers and manholes, together with their locks and fastenings; but not including steelwork of the shaft caissons, steel beams and shapes, steel rods and bars, special steel structures, high tensile steel or copper steel;

71. For steel forming part of the completed work of the shaft caissons, including all steel beams in the roofs of the land shaft caissons, but not including steel rods and bars;

72. For steel beams and shapes, including all single beams, channels, angles or other single shapes, whether milled or otherwise, with or without connections or other details, but not including steelwork of the shaft caissons or the special rolled floor beams for the tunnel roadway;

73. For steel rods and bars for reinforcing concrete;

74. For wire mesh;

75. For special steel structures;

76. For high tensile steel; or

77. For copper steel;

which price shall be in full compensation for furnishing

SPECIFICATIONS—WROUGHT-IRON AND STEEL PIPE.

and erecting or placing the steel complete and all expense in connection therewith or incidental thereto, including fitting, riveting, bolting, caulking, cleaning where required; and including, in the case of Schedule Item 71, all expense of furnishing, placing and removing portions not forming part of the completed work; and in the case of Schedule Item 76(a), all expense of furnishing, placing, re-tightening and renewing bolts, nuts and washers, and renewing grommets to make the tunnel water-tight.

ITEMS 83-85—WROUGHT IRON.

83-1. All wrought iron shall be double rolled, tough, fibrous and uniform in character. It shall be thoroughly welded in rolling and free from surface defects.

Character
and finish.

83-2. The methods specified for testing rolled steel shall apply generally to wrought iron. Standard test specimens shall show an ultimate tensile strength of at least fifty thousand (50,000) pounds per square inch, and an elongation of at least eighteen per centum (18%) in eight (8) inches, with fracture wholly fibrous. Specimens shall bend cold, with the fibre, through one hundred and thirty-five degrees (135°), without sign of fracture, with inner radius not to exceed the thickness of the piece tested. When nicked and bent the fracture shall show at least ninety per centum (90%) fibrous.

Tests.

WROUGHT-IRON AND STEEL PIPE.

83-3. Standard wrought-iron and steel pipe and miscellaneous wrought-iron fittings shall be furnished and placed as shown on the contract drawings or as required by the Engineer.

Placing and
testing pipe.

SPECIFICATIONS—GALVANIZED METAL: TUNNEL DUCTS.

All pipe shall be securely fastened to the tunnel lining or otherwise supported in an approved manner, and all joints shall be made with standard couplings sufficiently tight to withstand a pressure of at least two hundred (200) pounds per square inch. At the time of placing, the pipe shall be tested to the pressure mentioned above in such lengths as may be required by the Engineer. After the system is partially or wholly completed it shall be thoroughly flushed out and all hydrants opened and closed under pressure so as to thoroughly test the completed portion of the system. Prior to final acceptance all lines shall again be tested to the pressure required above.

Payment for miscellaneous wrought-iron fittings.

83-4. Ladders, hand bars and miscellaneous wrought-iron fittings not otherwise provided for (but not including pipe or pipe fittings) will be paid for at the price stipulated in Schedule Item 83, which price shall be in full compensation for furnishing and placing such fittings complete and all expense in connection therewith or incidental thereto.

Measurement and payment, wrought-iron and steel pipe.

83-5. Standard wrought-iron and steel pipe in the Tunnel will be measured for payment at their actual length as laid, and payment therefor will be at the appropriate price stipulated in Schedule Item 84, which price shall be in full compensation for furnishing and placing the pipe complete and all expense in connection therewith or incidental thereto, including couplings, wyes, tees, valves (but not furnishing valves), expansion bolts, hanger bolts, wall brackets and all other specials required.

ITEMS 85-86—GALVANIZED METAL.

Physical requirements.

85-1. Galvanized metal shall be evenly and thoroughly galvanized, of a bright appearance, free from pits, blisters

SPECIFICATIONS—GALVANIZED METAL: TUNNEL DUCTS.

and other defects. All sheet metal shall be commercially flat, and no rerolling of the plate after leaving the galvanizing bath will be permitted except for the purpose of straightening. If the metal is bent to an angle of ninety degrees (90°) or scraped with a knife, the coating must not break off.

85-2. The increase in weight due to galvanizing shall not exceed $2\frac{3}{4}$ oz. nor shall it be less than 2 oz. per square foot of surface coated.

Amount of
coating.

85-3. All conduits for electric wires, unless otherwise specified, shall be rigid type, made of galvanized iron or steel and shall be built in or on the walls or roof or other parts of the tunnels. The Contractor will not be required to furnish or place wiring.

Tunnel
conduits.

85-4. Electric conduits shall be delivered on the work in bundles of standard length pipe, each length marked with the trade mark of the manufacturer. They shall bend cold ninety (90) degrees about a radius equal to ten (10) diameters without flaw or fracture. Samples of conduits and boxes shall be submitted for approval before proceeding with the work.

Quality.

85-5. Most conduits will be imbedded in concrete or masonry, but portions of the runs may be left exposed. All conduits shall be carefully cleaned both before and after placing, all ends shall be reamed free from burrs, and inside surfaces shall be free from all imperfections which might injure the cable.

Placing and
cleaning.

85-6. Conduits built into concrete or other parts of the structure shall be properly supported and protected so as to prevent their injury by subsequent operations.

Support and
protection.

SPECIFICATIONS—GALVANIZED METAL: TUNNEL DUCTS.

Conduits not built into the structure shall be supported by approved pipe straps located not more than eight (8) feet apart, or in any other manner designated by the Engineer, and shall be kept boxed or otherwise suitably protected from injury.

Joints.

85-7. All joints shall be made with standard couplings well treated with red lead. All free ends shall be threaded and capped and all connections shall be water-tight.

Bends and offsets.

85-8. Bends and offsets may be made on the work if proper tools are used, but in no case shall deformed, split or crushed conduits be used. All bends shall be of as large a radius as possible. Not more than two (2) right-angle bends shall be made between any two (2) outlet boxes unless permitted by the Engineer.

Conduits to terminate in outlet boxes.

85-9. Conduits imbedded in concrete or masonry shall be brought outside such concrete or masonry at the ends of the runs and shall terminate in outlet boxes or in threaded ends properly protected, and located as shown on the contract drawings or as required by the Engineer.

Pull and outlet boxes.

85-10. Pull and outlet boxes and plug receptacles shall be weatherproof (marine type) with galvanized cast-iron bodies and covers provided with gaskets. The covers shall be fastened to the bodies with galvanized screws.

Air flues.

85-11. Air flues shall be made of No. 20 gauge galvanized sheet metal, reinforced with 1" x 1" x 1/8" plain steel angles and malleable iron inserts, with copper steel set screws, as shown on the contract drawings. The air flues shall be so fastened and protected as to avoid being in-

SPECIFICATIONS—GALVANIZED METAL: TUNNEL DUCTS.

jured or dented while concrete is being placed around them.

85-12. Tunnel conduits will be measured for payment at their actual length in place in the work, without deductions for space occupied by pull, outlet or junction boxes, and payment therefor will be at the price stipulated in Schedule Item 85, which price shall be in full compensation for furnishing and placing such conduits complete and all expense in connection therewith or incidental thereto, including bending, cleaning, attachments, connections and boxing.

Measurement
and payment,
tunnel
conduits.

85-13. Outlet boxes with or without plug receptacles, and pull boxes in place and connected, will be estimated for payment at the number of each so placed in accordance with the drawings or orders, and payment therefor will be at the price stipulated in Schedule Item 86 (a) for outlet boxes with or without plug receptacles and in Schedule Items 86(b) and 86(c), for pull boxes, which prices shall be in full compensation for furnishing and placing such boxes or boxes and receptacles complete and all expense in connection therewith or incidental thereto, including attachments and connections.

Measurement
and payment,
pull and out-
let boxes.

85-14. Galvanized sheet metal air flues will be estimated for payment at the number placed in accordance with the drawings or orders, and payment therefor will be at the price stipulated in Schedule Item 86(d), which price shall be in full compensation for furnishing and placing the air flues complete and all expense in connection therewith or incidental thereto, including the corner and frame angles, the malleable iron inserts and the copper steel set screws.

Payment,
air flues.

SPECIFICATIONS—CAST STEEL.

Payment,
miscellaneous
galvanized iron
fixtures.

85-15. Miscellaneous galvanized iron fixtures, including galvanized steel guards (curb guards), will be estimated for payment on the basis of the quantity actually placed in accordance with the drawings or orders. Weight for payment will be the actual weight in place. Payment for miscellaneous galvanized iron fixtures will be at the price stipulated in Schedule Item 86(e), which price shall be in full compensation for furnishing and placing the fixtures complete and all expense in connection therewith or incidental thereto.

ITEM 88—CAST STEEL.

Open-hearth
process.

88-1. Steel for castings shall be made by the open-hearth process, the electric furnace process, or both.

Chemical
properties.

88-2. Cast steel shall contain not more than 5/100 of 1 per centum of phosphorus, 5/100 of 1 per centum of sulphur, 8/10 of 1 per centum of manganese or 35/100 of 1 per centum of silicon.

True and
sound.

88-3. Steel castings shall be true to pattern and free from injurious blow holes and other imperfections.

Annealing.

88-4. All steel castings shall be annealed.

Tensile and
bending
requirements.

88-5. Cast steel shall have an ultimate tensile strength of not less than 65,000 pounds per square inch, a yield point at not less than 35,000 pounds per square inch, an elongation in two (2) inches of not less than twenty per centum (20%), a silky or fine granular fracture and shall be capable of being bent 120 degrees around a bar of diameter three times the thickness of the specimen without fracture.

SPECIFICATIONS—CAST STEEL.

88-6. For steel castings, the tension test pieces shall be turned to a uniform minimum section of one-half ($\frac{1}{2}$) inch diameter, for a length of at least two and one-half ($2\frac{1}{2}$) inches. Specimens for bending shall be one (1) inch by one-half ($\frac{1}{2}$) inch in section. Test pieces.

88-7. For steel castings, the number of tests will depend on the character and importance of the castings. Specimens shall be cut cold from coupons molded and cast on some portion of one or more castings from each melt. The coupon shall be annealed with the castings before being cut off. Number of tests.

88-8. The requirements for cast steel as to making chemical determinations to be furnished by the Contractor and the manner of determining the yield point and the elongation shall be the same as for rolled steel, and the requirements as to the general character of workmanship, except as herein specified, shall be the same as for cast-iron. Requirements, general.

88-9. The cast-steel tunnel lining shall be finished, coated, machined, tested, inspected, weighed, marked, erected and in every other way conform to the requirements (where not otherwise specifically stated) specified for cast-iron lining, including taper rings, as described in Sections 90-3 to 90-14, inclusive. In addition, cast-steel pile segments shall be furnished, together with the necessary gaskets, packing and closing pieces, for the purpose of driving piles under the cast-steel lining, if required. Cast-steel tunnel lining.

88-10. The actual finished weight of any steel casting shall differ by not more than four per centum (4%) from the Engineer's calculated weight. The aggregate weight estimated for payment, however, shall not exceed the cal- Variation in weight.

SPECIFICATIONS—CAST IRON.

culated weight by more than two per centum (2%). In calculating weights, the weight of one (1) cubic foot of cast-steel will be taken at four hundred ninety (490) pounds.

Measurement
and payment,
cast-steel
tunnel lining.

88-11. Measurement and payment for cast-steel tunnel lining (except pile segments) will be made in the manner specified for cast-iron tunnel lining in Section 90-16, except that weight for payment will be subject to the limitations of Section 88-10 and payment will be made at the price stipulated in Schedule Item 88(a).

Measurement
and payment,
cast-steel
pile segments.

88-12. Measurement and payment for cast-steel tunnel lining pile segments will be made in the manner specified for cast-iron tunnel lining in Section 90-16, except that weight for payment will be subject to the limitations of Section 88-10, and payment will be made at the price stipulated in Schedule Item 88(b), which price shall include furnishing and placing gaskets, packing and closing pieces.

ITEMS 90-95—CAST IRON.

CAST-IRON TUNNEL LINING.

Chemical
properties.

90-1. Cast iron, except as specified in Section 91-1 for pipes, shall be tough gray iron made from iron remelted in a cupola or air furnace and shall contain not more than six-tenths of one per centum (0.6%) of phosphorus and not more than twelve-hundredths of one per centum (0.12%) of sulphur. First-class machinery scrap approved by the Engineer to the amount of thirty per centum (30%) of the total melt may be used, but no mill cinder, white or burnt iron, or any other scrap iron, will be permitted in the composition.

SPECIFICATIONS—CAST IRON.

90-2. The strength of the iron entering into castings shall be determined by means of the "Arbitration Bar." This bar is to be one and one-quarter ($1\frac{1}{4}$) inches in diameter and fifteen (15) inches long, cast vertically under the same circumstances as those which attended the casting of the full-sized piece. This bar shall sustain at the center, when resting upon two dull knife edges twelve (12) inches apart, a load of three thousand (3,000) pounds with a deflection of at least one-tenth ($1/10$) inch before rupture.

Bending test.

Two (2) sets of two (2) bars shall be cast from each heat, one set from the first and the other set from the last iron entering into the castings. Each set of two (2) bars shall be made in a single mold.

90-3. Castings shall be made with a sinking head sufficiently high to insure sound metal throughout. They must have clean, smooth surfaces and must be free from blow holes, cold shuts, flaws, fins and surface imperfections. Castings having blow holes plugged or puttied will be rejected. Castings shall conform accurately to the form and dimensions shown on the drawings, and sufficient allowance must be made for machining. Each casting shall have its distinguishing letter or number cast in it as indicated on the drawings. All castings shall be neatly chiseled, and wire-brushed, dressed, sand blasted or cleaned by other approved methods before leaving the foundry. Each casting shall be weighed and the weight distinctly marked on it in white paint.

Soundness
and finish.

90-4. Green sand molds are to be used in casting tunnel segments and such methods of moulding shall be employed as will produce a casting having the greatest resistance to corrosion. The segments shall be poured from iron immediately drawn from the furnace, and in quantities sufficient to fill all parts of the mold quickly. Sufficient risers shall be supplied to insure sound castings.

Tunnel
segments.

SPECIFICATIONS—CAST IRON.

Tests.

Segments shall be broken at the foundry from time to time, as the Engineer may require. If the segments are sound and of a strength corresponding with that required for the test bar, the Commissions will pay the net cost of furnishing and breaking unmachined castings, less their value as scrap. If such segments are found defective, the expense of breaking shall be borne by the Contractor and such steps shall be taken by the foundry as may be necessary to remedy the defects.

Cored holes.

90-5. Bolt holes in segments of the cast-iron tunnel lining may be either cored or drilled. They shall be circular, of one-fourth ($\frac{1}{4}$) inch larger diameter than the diameter of the bolt used, shall be correctly spaced and shall be perpendicular to the plane of the joint. They shall be filleted on the face opposite the joint as shown on the drawings. The holes in segment stiffeners shall be as shown on the contract drawings.

Protective covering.

90-6. Coal tar pitch or other approved coating shall be applied to the segments at the foundry. The pitch shall be distilled free from naphtha, and shall be deodorized in a mixture of five per centum (5%) of linseed oil and must not be hard or brittle when cold. It is to be heated carefully in a suitable vessel to a temperature of three hundred degrees (300°) F. and maintained at this temperature during the process of application. It shall be replenished frequently as it deteriorates or thickens. The coating in any case shall be of such composition as will best protect the iron and of such a consistency that it will not be unduly soft in warm weather or chip or flake in cold weather. Each segment shall have the coating applied in an approved manner on the outside, or back, while the segment is at a temperature above one hundred seventy-five degrees (175°) F.

SPECIFICATIONS—CAST IRON.

90-7. All tunnel segments shall have the outside of the flanges machined to correct form and dimensions. After a segment has been machined, it shall be tested by applying substantial steel templates to all machined faces, the templates having the exact form required for the faces and having plugs attached of the exact diameter of the bolts outside the threads and of sufficient length to pass entirely through the cored holes. The plugs must enter the bolt holes freely and the joints must correspond exactly with the template. The templates shall be furnished by the Contractor and shall be satisfactory to the Engineer.

Joints to be machined.

90-8. Taper rings shall be used to correct any deviations in the tunnel lining from the line and grade shown on the drawings, also to prevent binding between the shield and the tunnel lining.

Taper rings.

Taper rings shall have their longitudinal joints machined first and shall then be machined on the circumferential joints while the segments forming a complete ring are firmly bolted together. While the ring is thus assembled, it shall be given a number and this number shall be plainly painted on each segment with white paint. The figures designating its place in the ring shall be cast in each end of each segment. Taper rings shall have their variation in width cast in the web. The segments of each taper ring shall be shipped together. A sufficient number of complete taper rings shall always be on hand at the work ready for immediate use.

90-9. Each tunnel segment shall have a rebate extending along the edge of the flanges to form a caulking recess after the segments are erected. The rebate shall be formed in molding, shall be one and one-quarter ($1\frac{1}{4}$) inches wide, and may vary in depth, from the plane of the machined face of the flange, between one-eighth ($\frac{1}{8}$) inch and three-sixteenths ($\frac{3}{16}$) inch.

Caulking recess.

SPECIFICATIONS—CAST IRON.

Tunnel segments to be interchangeable.

90-10. In each type of tunnel ring, except taper rings, all similar segments shall be of such uniformity in dimensions that they will be interchangeable with each other and with similar segments of other rings of the same type. The spacing of bolt holes must be so accurate that any two (2) rings can be bolted together in any relative position. These requirements shall be tested whenever required by the Engineer by assembling and bolting up the segments for at least three (3) rings in a horizontal position, under which conditions the faces of the rings thus bolted up shall be true plane surfaces. The outer edge of the face of any ring shall vary nowhere more than three-fourths ($\frac{3}{4}$) inch from a true circle, nor shall the circumference vary more than three-fourths ($\frac{3}{4}$) inch from that shown on the drawings.

Grouting holes.

90-11. Each tunnel segment shall be tapped with a hole near the center for a grouting connection. The hole shall be threaded with a standard pipe thread and closed by a screw plug. When the plug is screwed tight, the hole must be entirely filled with the plug.

Machined surfaces to be coated.

90-12. Machined surfaces shall be coated before leaving the shop with a mixture of white lead and tallow.

Lugs for erection.

90-13. If the Contractor considers it desirable for the purpose of facilitating erection or handling, he may have the tunnel segment cast with a lug or bracket of a form and in a location to be subject to the approval of the Engineer, but no payment will be made for such lugs or brackets, and their weight, as computed by the Engineer, will be deducted from the weight of the casting in estimating the weight for payment.

SPECIFICATIONS—CAST IRON.

90-14. In erecting the cast-iron lining special precaution shall be taken to preserve the circular form of the tunnel and to preserve the plane of the face of the ring. The machine surfaces of the segments shall be cleaned before being taken into the tunnel and when in contact shall be perfectly free from sand, cement or other material preventing a uniform bearing. Grommets, as specified in Section 60-17, shall be placed under the washers at the head and nut of each bolt at the time the segment is being bolted. Each segment shall be bolted, immediately upon being placed, with a sufficient number of bolts to hold it closely and firmly in contact with adjacent segments before the succeeding segment is placed. The segments in the invert (the number of segments to be determined by the Engineer) shall be fully bolted and all bolts made tight before the remainder of the ring is erected. Each ring shall be fully bolted, all bolts made tight and all the bolts of the two (2) preceding rings re-tightened before the erection of the next ring is begun. A method of tightening will be required by which bolts can be placed under a unit stress of twenty-five thousand (25,000) pounds per square inch and a bolt will not be considered tight until placed under this stress. As soon as a ring is erected, temporary tie-rods, if required, of sufficient strength to prevent distortion of the tunnel lining, provided with turnbuckles, shall be attached to the flanges by means of clevises and shall be kept tightly drawn up to prevent distortion of the ring. These tie-rods are to be placed on any diameter according to the directions of the Engineer and shall not be removed until all tendency to distortion disappears, and should such tendency reappear at any time, they shall be replaced immediately. The segments in the successive rings shall break joints as fully as possible. Before any ring is erected, the last ring erected

Erection of
tunnel lining.

SPECIFICATIONS—CAST IRON.

will be carefully examined and any broken or cracked segments shall be replaced by sound ones. Any segments subsequently found broken or defective shall be removed and replaced, if required by the Engineer, or he may, at his option, in lieu of such replacement require that the segment be repaired in place or otherwise strengthened and reinforced to his satisfaction.

Variation
in weight.

90-15. The actual finished weight of any casting, except as otherwise specified for pipes in Section 91-18, shall differ by not more than two and one-half per centum ($2\frac{1}{2}\%$) from the Engineer's calculated weight. The aggregate weight estimated for payment, however, shall not exceed the calculated weight by more than one per centum (1%). In calculating weights, the weight of one (1) cubic foot of cast-iron will be taken at four hundred fifty (450) pounds.

Measurement
and payment,
cast-iron tunnel
lining.

90-16. Cast-iron tunnel lining, including the lining in the cross passage and all special and taper rings, will be estimated for payment on the basis of the quantity actually placed in accordance with the drawings or orders. Weight for payment will be the invoice weight of all cast-iron so placed, subject to the limitations specified in Section 90-15, including the weight of grouting plugs, but not including the weight of lugs or brackets attached for the purpose of facilitating erecting and handling or the weight of materials used in caulking or recaulking joints. The weight of castings broken and removed will not be estimated for payment. Broken or defective castings left in place in the lining, but repaired, strengthened or reinforced, will be included for payment; but no allowance will be made for any expense incurred in such repair, strengthening or reinforcing.

Payment for cast-iron tunnel lining will be at the price

SPECIFICATIONS—PIPE.

stipulated in Schedule Item 90, which price shall be in full compensation for furnishing and erecting the cast-iron lining, including the caulking, complete and all expense in connection therewith or incidental thereto, including repairing, strengthening and reinforcing, where required, all recaulking, filling and pointing the joints; but not including tunnel bolts provided for in Schedule Item 76.

CAST-IRON PIPE AND SPECIAL CASTINGS.

91-1. New cast-iron pipe, except gas pipe and special pipe used in sub-surface changes, shall conform to the specifications of this Item. New pipe.

For gas pipes and special pipes, the weights and all other requirements shall be in accordance with the standard specifications and requirements of the owners of such pipes, but weight for payment will be estimated in accordance with the provisions of this Item.

Cast-iron pipes and special castings shall be made of pig iron remelted in a cupola or air-furnace, without any admixture of mill cinder, white or burnt iron, or other inferior metal. The iron shall be of such character as to make a pipe strong, tough and of even grain, entirely free from uncombined carbon when seen under the microscope, and such as will bear satisfactorily drilling and cutting, and shall have a tensile strength of at least sixteen thousand (16,000) pounds per square inch. Cast iron
for pipes.

Other requirements not specifically mentioned under this Item are to be as specified in Item 90 for cast-iron tunnel lining.

91-2. The pipes shall be designated by their interior diameters. Designated
by interior
diameter.

SPECIFICATIONS—PIPE.

To be
cylinders.

91-3. The pipes shall be circular cylinders with the inner and outer surfaces concentric and of the full interior diameter required.

Straight pipe.

91-4. All straight pipe shall be straight in the direction of the axis of the cylinder.

Length of
straight pipe.

91-5. The straight pipe shall be twelve (12) feet long exclusive of hub, except where the use of shorter pipe is directed. Other pipe shall be of such lengths as may be directed.

Hubs and
spigots.

91-6. The hub or socket and the spigot ends of pipe used in sub-surface structures shall be shaped in exact conformity with the standards of the City Department having jurisdiction over the same, and will be tested by circular gauges. Tunnel service pipe shall conform to the same standards.

Sockets and
spigots to
be straight
and even.

91-7. The seat or shoulder of the socket and the end of the spigot shall be straight and even and at right angles to the axis of the pipe, so as to make a smooth, tight joint. Special care will be required in making the sockets and spigots conform to the drawings. No pipe will be received if its eccentricity at either the socket or the spigot end exceeds one-tighth ($\frac{1}{8}$) inch or if its dimensions differ by more than one-eighth ($\frac{1}{8}$) inch from those required.

Bands, lugs,
etc.

91-8. Bands, lugs, buttons or ribs of such forms and dimensions as the Engineer may direct shall, if required, be cast on the pipes.

General re-
quirements.

91-9. The thickness and weights of all sub-surface pipe, methods of laying and testing and all other requirements for such pipe shall conform strictly to the standard re-

SPECIFICATIONS—PIPE.

quirements of the City Department having jurisdiction over the same.

91-10. The weights of straight sub-surface pipe, in pounds per length of twelve (12) feet, shall be as follows:

Weights of
straight sub-
surface pipe.

4-inch	265	24-inch	2965
6- "	416*	30- "	4460
8- "	542	36- "	5920
10- "	766*	42- "	special
12- "	1018	48- "	9886
16- "	1458	60- "	special
20- "	1979		

*In case of the six (6) and ten (10) inch pipes used in the tunnels, the weights of straight pipe in pounds per length of twelve (12) feet shall be as follows:

Weights of
tunnel pipe.

6-inch	430
10-inch	850

91-11. The character of metal for castings and the finish of castings shall be in accordance with the requirements specified in Sections 90-2 and 90-3 for cast-iron tunnel lining, and in accordance with the requirements specified in this Item.

Character and
finish of
castings.

91-12. All straight pipes shall be cast vertically, and all pipes twelve (12) inches or more in diameter shall be cast with the hub end down.

Straight pipe
cast vertically.

91-13. All castings shall be made in such moulding-sand or loam as will leave the surface clean and smooth.

Surface finish.

91-14. All castings shall have the year in which they are cast, the running number of the castings of the

Distinguishing
work.

SPECIFICATIONS—PIPE.

same size and form, the letters H. R. V. T., the initials or name of the Contractor and of the foundry where cast, cast on the outer side in raised letters not less than two (2) inches in length and one-eighth ($\frac{1}{8}$) inch in relief, in such manner as the Engineer may designate; and in addition all castings must meet the requirements of the City Department having jurisdiction over the same.

Cleaning.

91-15. The castings shall be perfectly cleaned and no lumps shall be left on the inner surface of the barrels or sockets or on the outer surface of the spigot end. The castings shall be subject to hammer inspection. Wire brushes shall be used to remove material adhering to the castings as well as softer brushes to remove the loose dust. No acid or other liquid shall be used in cleaning the castings.

Thickness to be calipered.

91-16. The thickness of the metal of the pipes and special castings will be tested by calipers after the castings have been freed from sand and cleaned.

Variation in thickness.

91-17. No pipe will be received when the thickness of metal is less by more than one-twelfth ($\frac{1}{12}$) inch than the thickness required by the standards.

Variation in weight.

91-18. Any straight pipe, the weight of which is deficient by more than the following stated percentage of the standard weight, will be rejected:

For pipe 16 inches or less in diameter, 5%.

For pipe over 16 inches in diameter, 4%.

Excess weight in any one pipe not exceeding the above

SPECIFICATIONS—PIPE.

stated percentages will be estimated for payment when payment for pipe is made by weight. The total weight to be estimated for payment, however, shall not exceed, for each size of pipe received, the sum of the standard weights of the same number of pieces of the given size by more than two per centum (2%).

(The term "standard weight" as above used in connection with straight pipe shall be taken to mean the standard weight corresponding to the actual laying length of the pipe as furnished.)

Any special castings, the weight of which is deficient by more than the following stated percentages of the standard weight, will be rejected:

For special castings 12 inches or less in diameter,
10%.

For special castings over 12 inches in diameter,
8%.

Excess weight in any one special casting, not exceeding the following stated percentages, will be estimated for payment when payment for pipe is made by weight:

For special castings 12 inches or less in diameter,
8%.

For special castings over 12 inches in diameter,
6%.

The total weight to be estimated for payment, however, shall not exceed, for the special castings received, the sum of the standard weights of the same number of special castings by more than five per centum (5%).

91-19. After being cleaned and while still hot, at a temperature of about three hundred degrees (300°) F.,
Protective coating.

SPECIFICATIONS—PIPE.

cast-iron pipe and other castings not specifically required to be painted shall be dipped in a bath of coal tar pitch as specified in Section 90-6, or other approved coating previously heated to the same temperature. If it should be impracticable to dip the castings before cooling, they shall be completely coated inside and outside, immediately after cleaning, with linseed oil to prevent rusting until dipped. When dipped the castings shall remain in the bath until they have attained a temperature of three hundred degrees (300°) F. No castings shall be dipped after rust has set in. After being dipped, the castings shall be removed slowly from the bath and laid on skids to drip and cool before machining.

Hydraulic test.

91-20. After being dipped, all pipe shall be subjected, at the foundry, at the Contractor's expense, to an internal hydraulic pressure of not less than three hundred (300) pounds per square inch. Any piece which shows any defects by leaking, sweating or otherwise, will be rejected.

Weighing and marking.

91-21. Each casting shall be weighed and the weight distinctly marked on it in white paint. The Contractor shall provide free of charge at the foundry where the pipes are to be cast the use of properly sealed scales and weights for weighing the castings under the supervision of the Inspector.

Specials.

91-22. Stop cocks, boxes, branches, curved pipe and other specials required for new water pipes shall be furnished and set where necessary according to the standards of the City Department having jurisdiction over the same, or in the tunnel as required by the Engineer.

SPECIFICATIONS—PIPE.

91-23. Each pipe shall be properly supported on blocks and wedged to the required elevation as directed by the Engineer.

Supporting
pipes.

91-24. The spigot end of the pipe shall be inserted into the hub to within from one-fourth ($\frac{1}{4}$) to one-eighth ($\frac{1}{8}$) inch of the full depth of the hub, and the space around the pipe shall be equalized so as to give as nearly as possible an equal space for the packing. The space between the pipe and hub shall be packed with clean, sound jute, hemp or sisal packing yarn, free from tar, far enough to leave the proper space for lead. The remaining space shall then be filled by running it full of lead, leaving a bead outside of the face of the hub large enough to allow for thorough caulking. After the joint shall have been run with lead, it shall be caulked by means of proper tools so as to make a water-tight joint.

Joints.

91-25. The lead to be used for caulking shall be of the best quality of pure soft lead and shall be in every respect suitable for the purpose.

Lead.

91-26. Weight for payment will be the invoice weight of all pipe and special castings entering into the structure, subject to the limitations of Section 91-18 as to excess weight.

Payment
weight.

91-27. Payment for furnishing new cast-iron pipe required for sub-surface structures, and having either bell and spigot or universal joints, including both straight pipe and special castings, will be at the price stipulated in Schedule Item 91 or 92.

Payment
for pipe.

91-28. Payment for furnishing and placing new cast-iron manhole and catch basin fixtures, gratings, drain covers and castings not otherwise provided for, but not

Payment for
gratings and
miscellaneous
castings.

SPECIFICATIONS—PIPE.

including pipe or pipe fittings, will be at the price stipulated in Schedule Item 95(a), which price shall be in full compensation for furnishing and placing the castings complete, and all expense in connection therewith or incidental thereto, including rubber gaskets.

Gate valves
and hydrants.

91-29. Payment for furnishing new valves or hydrants, not otherwise herein provided for, will be made as provided in Schedule Item 300.

ITEM 100—TUNNEL SERVICE PIPE.

Cast-iron
tunnel service
pipe.

100-1. Cast-iron water, discharge and other tunnel service pipe shall conform to the requirements for cast-iron pipe as specified in Sections 91-1 to 91-29, inclusive. It shall be laid to the line and grade furnished by the Engineer, shall be caulked with lead as specified in Sections 91-24 and 91-25 and shall be tested under hydrostatic pressure to two hundred (200) pounds per square inch in accordance with the methods prescribed in Section 83-3. If the pipe is encased in concrete, the hydrostatic test shall be applied before the concrete is placed.

Payment for
cast-iron tunnel
service pipe.

100-2. Cast-iron water, discharge and other tunnel and shaft service pipe, including bell and spigot elbows and tees, flanged, faced and drilled elbows and tees, and all other specials will be measured for payment at the actual length as laid, without deductions for space occupied by valves, and payment therefor will be at the appropriate price stipulated in Schedule Item 100, which price shall be in full compensation for furnishing and placing the pipe lines complete and all expense in connection therewith or incidental thereto, including wyes, tees and other specials, capping of dead ends, setting

SPECIFICATIONS—PAINTING.

valves and traps (but not furnishing valves and traps), caulking, testing and making connections with the water main, sewer or other pipe.

100-3. Payment for furnishing connections, nipples, valves and traps will be made as provided in Schedule Item 300.

Payment for valves and traps.

ITEM 105—PAINTING.

105-1. All metal work, excepting as otherwise herein provided, shall be painted with three (3) coats of paint, as follows: shop coat, second coat and finishing coat.

Number of coats.

The finishing coat will be gray paint if adjacent to concrete, otherwise black paint.

105-2. Paint shall be subject to inspection at the place of manufacture and to such tests as may be ordered by the Engineer. The Inspector shall have access, at all times, to all places to inspect the methods of manufacture, and shall have liberty to inspect the daily laboratory records and analyses of all such paints as are subject to his inspection.

Inspection.

The Contractor shall furnish all facilities required for the proper inspection of the paint and its manufacture. All containers will be sealed by the Inspector at the time of inspection.

105-3. All proportions mentioned in this specification are by weight, except when otherwise noted.

Proportions by weight.

105-4. The paint formulae are as follows:

PAINT FORMULAE.

	Shop Coat	Second Finishing Coat		
		Coat	Gray	Black
Pigment	500 lbs.	49%	60%	26%
Vehicle	16½ gal.	51%	40%	74%

Paint formulae.

SPECIFICATIONS—PAINTING.

VEHICLE FORMULAE.

Raw Linseed Oil ....2/3 by volume	90%	92%	92%
Boiled Linseed Oil ..1/3 by volume			
Drier	10%	8%	8%

PIGMENT FORMULAE.

Red Lead	100%	30%	....	25%
Red Iron Oxide .....	....	42%	....	....
Lampblack .....	....	5%	*	50%
Magnesium Silicate ..	....	10%	....	10%
Silica .....	....	13%	10%	15%
Sublimed White Lead	....	....	60%	....
White Zinc .....	....	....	30%	....

Weights.

The standard weight of second coat shall be 12 pounds 10 ounces per gallon. The standard weight of finishing coat (gray) shall be 14 pounds 6 ounces per gallon. The standard weight of finishing coat (black) shall be 9 pounds 5 ounces per gallon.

Mixing.

105-5. The shop coat of paint shall be mixed, as needed, in such quantities as can be used before it thickens in the container. Any paint which settles and thickens before use shall be rejected and a new paint mixed.

The second and finishing coats shall be furnished in a ready mixed form and shall be used without the subsequent addition of any material.

All paints must be properly prepared, using only the specified materials in the proportions stated, with an allowable variation therefrom of not over two per centum (2%) in the quantity of any material therein. The paint

*Use sufficient lampblack to make standard shade.

SPECIFICATIONS—PAINTING.

must not vary more than four (4) ounces per gallon from the standard weight.

105-6. Raw linseed oil shall conform to the specifications of the American Society for Testing Materials for the purity of raw linseed oil from North American Seed, as revised in 1915.

Raw linseed oil.

Boiled linseed oil shall conform to the specifications of the American Society for Testing Materials, adopted in 1915. When linseed oil is flowed over a plate of glass and allowed to drain in a nearly vertical position, it shall dry free from tackiness in 15 hours at 70 degrees F.

Boiled linseed oil.

The drier shall be a pure oil drier consisting of lead and manganese salts dissolved in linseed oil and thinned with turpentine as follows:

Drier.

Fifteen pounds of manganese dioxide plus 20 pounds of red lead, dissolved in 50 gallons of varnish maker's linseed oil, boiled to proper consistency and thinned with 50 gallons of turpentine.

Turpentine shall be gum turpentine and shall conform to the specifications of the American Society for Testing Materials, adopted in 1915.

Turpentine.

105-7. Red lead for the shop coat shall be of the best quality, free from all adulteration and shall contain not less than 80% nor more than 90% "true red lead" (Pb_3O_4), not over 1% inert hearth materials (such as silica and alumina) and not more than 0.1% metallic lead; the remainder shall be pure lead monoxide (PbO). It must contain no organic coloring matter and when shaken up with water shall show no alkaline reaction. It shall be of such fineness that 99½% will pass through a standard 200 mesh sieve.

Red lead for shop coat.

Red lead for the second and finishing coats shall be of the best quality, free from all adulteration and shall con-

Red lead for second and finishing coats.

SPECIFICATIONS—PAINTING.

tain not less than 85% "true red lead" (Pb_3O_4), not over 1% inert hearth materials (such as silica and alumina) and not more than 0.1% metallic lead; the remainder shall be pure lead monoxide (PbO). It must contain no organic coloring matter and when shaken up with water shall show no alkaline reaction. It shall be of such fineness that 99½% will pass through a standard 200 mesh sieve.

Lampblack.

Dry lampblack must be absolutely neutral and contain at least 98%, by weight, of pure carbon. The tinting power of lampblack used in the finishing coat must be the same as the standard sample.

Magnesium silicate.

Magnesium silicate shall be a finely ground material of crystalline structure and shall equal the standard sample.

Silica.

Silica shall be ground from rock crystal and water floated. It shall be 99% pure silica (SiO_2) and shall be of such fineness that 99% shall pass through a standard 200 mesh sieve. It shall equal the standard sample.

Red iron oxide.

Red iron oxide shall contain at least 85% ferric oxide, the remainder to consist of silicates. The oxide shall contain no soluble sulphates, no free acids, shall give a neutral reaction and shall contain not over 0.1% sulphur in any form. It shall be free from grit and shall equal the standard sample in shade, quality and tinting power.

Sublimed white lead.

Sublimed white lead shall be a true basic sulphate of lead containing not less than 15% combined lead monoxide (PbO), not over 5% zinc oxide (ZnO), and shall contain not more than .075% of free sulphur dioxide (SO_2). Sublimed white lead shall equal in whiteness, fineness, body and covering qualities the standard sample.

White zinc.

White zinc shall be "American process," and shall contain at least 93%, by weight, oxide of zinc (ZnO), not more than 0.2% of sulphur in any form nor more than .075% free sulphur dioxide (SO_2). White zinc shall equal

SPECIFICATIONS—PAINTING.

in whiteness, fineness, body and covering qualities the standard sample.

105-8. The paint for the second and finishing coats shall be so finely ground that it will pass each of the following tests:

Tests for
second and
finishing coats.

(a) When a small amount is placed upon a piece of glass and the glass placed in a vertical position, there shall be no separation of the oil from the pigments for at least one (1) hour. This test is to be conducted at 70° F.

(b) Fill a $\frac{5}{8}$ inch test tube with pure raw linseed oil to a height of $3\frac{1}{2}$ inches and add paint until the height of the oil is five (5) inches from the bottom. Cork, shake well and let stand in a vertical position for two (2) hours. The opaque mass must not have settled down more than $\frac{1}{2}$ inch and there must be no separation of the coarser particles in the bottom of the test tube. This test is to be conducted at 70° F.

(c) At least 98% of the extracted pigment shall pass through a standard 200 mesh sieve.

(d) When rubbed with a spatula on a piece of glass there shall be no feeling of grittiness.

105-9. By standard 200 mesh sieve is meant the 200 mesh sieve described in the specifications of the American Society for Testing Materials for Portland cement, adopted August 16, 1909.

Sieve.

105-10. The shade of the gray finishing coat shall match the shade of the standard sample.

Gray finishing
coat.

SPECIFICATIONS—PAINTING.

The paint shall dry under normal conditions, dust free, in 12 hours, and so as to be satisfactorily recoated in not less than 24 hours nor more than 48 hours.

The amount of hygroscopic moisture in the finished paint shall not exceed 0.5%.

There shall be no resin in the paint as indicated by the Liebermann-Storch reaction.

Paint not to curdle, etc.

105-11. The paint shall not liver nor curdle and must cover properly and work freely under the brush. The pigment shall remain in suspension in a satisfactory manner.

Place of manufacture.

105-12. Tests will be made against standard samples. Such analyses as are required will be made by the Engineer.

Due to the cost of inspection, the Contractor will be required to obtain paint which is made within a distance of one hundred (100) miles from New York City. By distance from New York City is meant the distance by railroad of the paint factory from Manhattan Island.

Standard samples.

Samples of standard ingredients and of the finished paints are on file in the office of the Engineer. Paints and their ingredients shall conform to these standard samples. The Contractor shall submit separate samples of all ingredients intended for use in the paints, and upon approval of same shall then submit two one-pint samples of paint for approval.

In those details where no special instructions are given the paint and its manufacture shall conform to the best accepted practice.

Samples from original packages.

All materials for shop coat shall be delivered, inspected and sampled in their original packages.

Shop coat.

105-13. All metal work shall be scraped free from scale and rust and shall receive one coat of red lead

SPECIFICATIONS—PAINTING.

paint, as herein specified, before leaving the shop. All surfaces which come in contact or are enclosed shall be painted before being assembled. All turned or faced surfaces shall receive a coat of white lead and tallow before leaving the shop. If the Engineer so directs, the shop coat will be omitted on members or parts of members to be imbedded in concrete, or to be covered with waterproofing material.

105-14. Where the shop coat has become damaged before or after erection, through any cause whatever, it shall be renewed with the same kind of paint as originally used, such renewal to be considered as a part of the original shop coat. Exposed field driven rivets shall be given a shop coat.

Renewal of
shop coat.

105-15. After erection the metal shall be thoroughly cleaned of all dirt, rust or scale by stiff wire brushes or sand blast, as directed, and afterward dusted. The Engineer may require that all steel after cleaning shall be wiped with a cloth dipped in a mixture composed of one-half ($\frac{1}{2}$) benzine and one-half ($\frac{1}{2}$) turpentine. When the above mixtures has practically dried, but before becoming absolutely dry, the steel shall be thoroughly and evenly painted with the second coat prescribed herein. No paint shall be applied until the cleaning has been passed upon by the Inspector.

Cleaning before
painting.

105-16. The finishing coat shall be applied at such time after the application of the second coat and before final acceptance of the work as in the judgment of the Engineer shall be advisable. All steelwork adjacent to concrete shall be painted with the gray finishing coat. All other steelwork shall be painted with the black finishing coat.

Finishing coat.

SPECIFICATIONS—NON-CORROSIVE METAL.

Inaccessible
surfaces.

105-17. Surfaces of exposed members inaccessible after erection shall be cleaned and painted before erection.

Recesses to
be filled.

105-18. All recesses that might contain water, or through which water could enter, must be filled with thick paint or a waterproof cement of ground skins before receiving the final painting.

All surfaces so close together as to prevent the insertion of a brush must be painted thoroughly by using a piece of cloth, if necessary. Gratings or covers shall be painted by dipping.

To be applied
uniformly.

105-19. All paint shall be well brushed out so as to show a smooth, even film of uniform thickness. Round brushes shall be used exclusively in applying paint, except that the Engineer may permit the use of flat brushes on large, flat surfaces only.

When not
permitted.

105-20. Painting in rainy or freezing weather or on wet or damp surfaces will not be permitted.

Payment.

105-21. Payment for painting is deemed to be included in the prices stipulated in the Schedule for steel and iron.

ITEM 107—NON-CORROSIVE METAL.

Non-corrosive
metal.

107-1. Non-corrosive metal shall be used for the air duct hanger as shown on the contract drawings or as ordered by the Engineer. It shall be composed principally of nickel and copper in approved proportions or of such other metals as in the opinion of the Engineer will offer complete resistance to corrosion.

SPECIFICATIONS—BRONZE.

107-2. All non-corrosive metal shall have an ultimate tensile strength of not less than 75,000 lbs. per square inch, an elastic limit of not less than 40,000 lbs. per square inch and an elongation of not less than twenty-five per centum (25%) in two (2) inches.

Physical re-
quirements.

107-3. Test specimens consisting of bars of full sized section, as required by the Engineer, shall be furnished by the Contractor to determine the physical properties. Each bar shall be capable of being hammered hot to a fine point and the material shall be free from all injurious defects; shall be clean, smooth and of uniform color, quality and size.

Tests.

107-4. Non-corrosive metal will be estimated for payment on the basis of the quantity actually placed in the work in accordance with the drawings or orders, provided, however, that the total weight estimated for payment shall not exceed the theoretical weight by more than two and one-half per centum (2½%).

Measurement
and payment,
non-corrosive
metal.

Payment for non-corrosive metal will be at the price stipulated in Schedule Item 107, which price shall be in full compensation for furnishing, placing and connecting the metal complete and all expense in connection therewith or incidental thereto, including drilling and tapping holes for connections with the tunnel rings.

ITEM 108—BRONZE.

108-1. All bronze used on the work shall be Government bronze, and shall conform to the following requirements:

Chemical
composition.

Copper,	not less than	86%	nor more than	89%				
Tin,	"	"	"	8%	"	"	"	11%
Zinc,	"	"	"	1%	"	"	"	3%

SPECIFICATIONS—BRONZE.

An analysis of each melt shall be made by the manufacturer, and the chemical composition thus determined shall be reported to the Engineer.

Physical requirements.

108-2. All bronze shall have an ultimate tensile strength of not less than 56,000 pounds per square inch, an elastic limit of not less than one-half ($\frac{1}{2}$) the ultimate tensile strength and an elongation of not less than twenty-five per centum (25%) in two (2) inches.

Test specimens to be furnished.

108-3. Specimens for physical and chemical tests shall be furnished by the Contractor as required by the Engineer.

No patching or plugging.

108-4. No patching or plugging of castings will be allowed and all bronze shall be cast in molds which are absolutely dry. No cold working of bronze will be permitted.

Measurement and payment, bronze.

108-5. Bronze will be estimated for payment on the basis of the quantity actually placed in the work, in accordance with the drawings or orders, provided, however, that the total weight estimated for payment, shall not exceed the theoretical weight as computed by more than five per centum (5%). In calculating weights, the weight of one (1) cubic foot of bronze will be taken at five hundred thirty-five (535) lbs.

Payment for bronze will be at the price stipulated in the Schedule Item 108(a), which price shall be in full compensation for furnishing and placing the bronze complete and all expense in connection therewith or incidental thereto.

Air-measuring apparatus, as shown on Contract Drawing No. 38, will be paid for as provided in Schedule Item 300.

SPECIFICATIONS—TUNNEL DUCTS.

ITEM 110—TUNNEL DUCTS.

110-1. The specifications of this Item relate to vitrified ducts to contain electric cables or other cables or wires. Such ducts are referred to in the Schedule and elsewhere herein as tunnel ducts.

Tunnel ducts.

110-2. Tunnel ducts shall be manufactured of the best clay, thoroughly mixed, burned and vitrified, sound in all respects, straight, free from soft spots, stones, cracks, blisters and other defects liable to injure their strength, durability, or non-conductivity. They shall be thoroughly and completely glazed, inside and outside, with good salt glaze. The interior surfaces shall be smooth and free from any projections or imperfections which may tend to injure the electric cable when being pulled through the duct. The ends shall be cut smooth and square with the axis. The ends of the holes shall be beveled on the inside for three-fourths ($\frac{3}{4}$) inch.

Quality,
soundness
and finish.

110-3. Single way ducts shall be combed on each face with at least five (5) longitudinal combings, each combing to have a width of one-quarter ($\frac{1}{4}$) inch and a depth of one-sixteenth ($\frac{1}{16}$) inch. Multiple ducts shall be combed as required by the Engineer.

Ends combed.

110-4. Four-way and six-way ducts shall have a standard length of thirty-six (36) inches. Single, two-way and three-way ducts shall have a standard length of eighteen (18) inches. Shorter lengths shall be used only as directed.

Length.

110-5. Duct holes shall be of such diameter as to pass a cylindrical mandrel three and one-half ($3\frac{1}{2}$) inches in

Holes circular.

SPECIFICATIONS—TUNNEL DUCTS.

diameter for circular openings and three and one-half ($3\frac{1}{2}$) inches square, with one-fourth ($\frac{1}{4}$) inch rounded corners, for rectangular openings, in each case the mandrel being thirty-six (36) inches long.

Thickness.

110-6. The outside walls and webs of four-way ducts shall be three-fourths ($\frac{3}{4}$) inch thick, and the outside dimensions shall be not less than nine and one-quarter ($9\frac{1}{4}$) nor more than ten (10) inches, and the outside walls shall be constructed square on outer lines. The dimensions of single, two-way and three-way ducts shall be consistent with the above.

Laid to line.

110-7. The ducts shall be so laid that the center of the holes shall be true to line and grade.

Laying.

110-8. The ducts shall be laid in beds of cement mortar about one-quarter ($\frac{1}{4}$) inch in thickness, with broken joints and with full bearing.

A strip of thick unbleached muslin six (6) inches wide, coated with neat cement mortar, asphalt or other approved material, shall be used to wrap each joint, the ends of the wrap to lap six inches (6''). The muslin shall have a thread count of not less than 56 x 60 per square inch and a weight not less than four (4) ounces per square foot.

In laying the ducts care must be taken to close abutting joints so that the ends of ducts shall be as nearly as practicable in contact on all sides. Where ducts are laid on curves, the wraps must be doubled, if required, to protect the openings between the ends of the ducts on the outer line of the duct and to exclude all mortar from duct opening.

Steel straps, as shown on the drawings, shall be used for bonding.

SPECIFICATIONS—TUNNEL DUCTS.

110-9. The ducts shall be laid with a straight mandrel, of length and diameter to be prescribed, accurately fitting the duct openings, and the mandrel shall be left in each duct until the next succeeding duct is laid.

To be laid
with mandrel.

110-10. Four-way and six-way ducts shall be laid with dowel pins at each joint.

Dowel pins.

110-11. After the concrete covering has been placed over the ducts they shall be rodded so as to remove all mortar and other foreign matter from the duct openings, leaving them clear and smooth. If obstructions are found, in rodding the ducts, which cannot be removed by cleaners so as to give a clear and smooth opening sufficient to pass a three and one-quarter ($3\frac{1}{4}$) inch mandrel, the ducts shall be removed and relaid. All ducts, immediately after laying and again after being rodded, shall be plugged with suitable plugs to be furnished by the Contractor at his own expense. If wooden plugs are used, they shall be impregnated with paraffine or other approved material before being put into place.

Rodding and
plugging.

110-12. All ducts shall be subject to inspection both at the place of manufacture and on the work. All rejected ducts shall be promptly removed by the Contractor at his expense.

Inspection.

110-13. Tunnel ducts will be measured for payment on the basis of their actual length in duct feet (lineal feet of equivalent single duct), as laid in the work, and payment will be made at the price stipulated in Schedule Item 110, which price shall be in full compensation for the complete furnishing, laying and rodding of such ducts and all expense in connection therewith or incidental thereto.

Measurement
and payment,
tunnel ducts.

SPECIFICATIONS—ASBESTOS MATERIAL.

Steel bonding straps will be measured as provided in Section 70-50, and paid for at the price stipulated in Schedule Item 73.

ITEM 112—ASBESTOS MATERIALS.

- Composition. 112-1. Asbestos lumber, as shown on the contract drawings or as ordered by the Engineer, shall be made of fibred asbestos, free from organic matter, impregnated with Portland cement and compressed into homogeneous, sound, dense sheets of uniform thickness throughout and shall have a smooth sand finished surface.
- Test pieces. 112-2. Test pieces of asbestos lumber of the thickness specified, in such quantity and size as may be directed, shall be furnished free of charge by the Contractor for tests.
- Tests. 112-3. All asbestos lumber furnished under this contract shall possess the following qualities as determined by test:
- Weight. (a) When dried in an oven for twelve (12) hours at a temperature of two hundred twenty degrees (220°) F. the one-fourth ($\frac{1}{4}$) inch thick material shall weigh not less than two and four-tenths (2.4) pounds per square foot.
- Absorption. (b) After being dried in the manner prescribed in the preceding paragraph, the test piece shall be immersed in water at room temperature. The water shall then be raised to the boiling point, after which it shall be allowed to cool for twenty-four (24) hours. The test piece shall then be removed and weighed. The increase in weight after immersion shall not exceed twenty per centum (20%).

SPECIFICATIONS—ASBESTOS MATERIAL.

(c) A test piece twelve (12) inches wide and of sufficient length to get proper bearing on supports separated by a distance of twelve (12) inches, shall, after drying as prescribed in paragraph (a) above, be capable of sustaining without rupture the loads indicated in the following table when applied to a cylindrical bar placed on the test piece midway between supports.

Breaking
strength, dry.

Thickness, inches.	Weight Dry, lbs. per sq. ft.	Load, lbs.
$\frac{1}{4}$	2.4	200

(d) Test pieces treated as prescribed for absorption shall, when wet, support, without rupture, loads within thirty-three and one-third per centum ($33\frac{1}{3}\%$) of that prescribed in the paragraph next preceding, and after drying as prescribed in paragraph (a) above, shall regain full strength shown prior to immersion.

Breaking
strength, wet.

(e) Test pieces heated with an electric muffler to a temperature of fifteen hundred degrees (1500°) F. shall, when cool, show no signs of disintegration, splitting or cracking other than fine surface hair cracks.

Heat test.

112-4. Measurement for payment of asbestos lumber one-fourth ($\frac{1}{4}$) inch in thickness will be of the area installed, in accordance with the drawings or orders.

Measurement
and payment,
asbestos
lumber.

Payment for asbestos lumber will be at the price stipulated in Schedule Item 112 (a), which price shall be in

SPECIFICATIONS—WATER PIPE CHANGES.

full compensation for furnishing and placing the lumber complete, and all expense in connection therewith or incidental thereto.

ITEM 114—CROSS PASSAGE.

Cross passage.

114-1. The cross passage between the river shafts shall be constructed, as shown on the contract drawings, according to methods approved by the Engineer, while the caissons are under compressed air.

Payment for items of the cross passage.

114-2. Payment for excavation, tunnel lining, connections to the shafts, concrete, grout and bolts, nuts and washers in the cross passage, will be made at the appropriate unit prices stipulated in the Schedule. No specific payment will be made for the lead sheets shown on the drawings, but payment therefor is deemed to be included in the unit price stipulated in the Schedule for tunnel lining.

ITEM 120—WATER PIPE CHANGES.

Measurement and payment, pipe changes.

120-1. Changing water or other pipes where required as may be necessary in order to avoid interference with the shafts or any work appurtenant thereto, and requiring the shifting, relaying or reconstructing such pipes with their connections and other appurtenances, to or in positions other than their original positions, will be estimated for payment on the basis of the actual length of pipe in the new position, as shown on the contract drawings or as ordered, and payment will be made at the appropriate price stipulated in Schedule Item 120, which price shall be in full compensation for the shifting, relaying or reconstructing such pipes, their connections and all other appurtenances, and all expense in connection therewith or incidental thereto, including laying the pipe, removing and disposing of the old pipe replaced, caulking and re-

SPECIFICATIONS—WATER PIPE CHANGES.

caulking of joints, placing valves, excavation, placing concrete, furnishing all labor and materials for service or other connections, backfilling and surface restoration and no other allowance will be made therefor excepting that:

(1) New pipe, ordered by the Engineer to take the place of such pipe as, in his opinion, cannot be preserved and used, and the water pipe and gas pipe called for in Section 123-1, will be estimated for payment, on the basis of the actual amount of new pipe in place, subject to the limitations of Section 91-18 as to excess weights, and payment will be made, in addition to the payment for changing, at the appropriate price stipulated in Schedule Items 91, 92 or 95, which price shall be in full compensation for furnishing the new pipe and all expense in connection therewith or incidental thereto.

New pipe.

(2) Excavation, outside the ordered net lines of excavation for the land shafts or any work appurtenant thereto, for any such pipe and its appurtenant valve chambers, valves, valve boxes and hydrants in their new required positions, and in excess of excavation otherwise required, will be measured as described in Sections 1-7, 1-11 and 1-13 and paid for at the price stipulated in Schedule Item 1.

Excavation.

(3) New valve chambers built in their new required positions in connection with water or other pipe changes, due to such valve chambers being in the new required position, will be measured as described in Sections 27-27, 70-50, 83-4, 85-15 and 91-28, and paid for at the prices stipulated in Schedule Items 27 (a), 72, 83, 86 (e) and 95 (a).

Valve chambers.

SPECIFICATIONS—NEW SUB-SURFACE STRUCTURES.

ITEMS 123-124—NEW SUB-SURFACE GAS PIPE AND
WATER PIPE LINES.

New sub-
surface gas
and water
pipe lines.

123-1. The laying of new gas pipe and water pipe lines, as the Engineer may require, from Jersey City mains through Parcels 34, 21 and "B", as shown on Contract Drawing No. 39, and such new pipe lines at other locations as the Engineer may direct, will be estimated for payment on the basis of the actual length of pipe laid, and payment will be made at the appropriate price stipulated in Schedule Item 123 or 124, which price shall be in full compensation for laying such pipe, including the caulking and recaulking of joints, placing valves, excavation, placing concrete, backfilling, surface restoration, making service connections, and all expense in connection therewith or incidental thereto, and no further allowance will be made therefor excepting that:

New pipe, excavation and building valve chambers will be estimated for payment and payment will be made, as provided in Paragraphs (1), (2) and (3) in Section 120-1.

No specific payment will be made for pipe laid on parcels "C" and 26, Contract Drawing No. 39, to serve the Contractor's plant and the Engineer's Field Office located thereon, but payment therefor is deemed to be included under the various unit prices of the Schedule.

SPECIFICATIONS—FIELD OFFICE: FENCING.

ITEM 148—ENGINEER'S FIELD OFFICE.

148-1. The Contractor shall furnish, in accordance with the contract drawings, a building for the Engineer's Field Office, supported in an elevated position on the site provided for the Contractor near the land shafts. The payment for this building will be made at the price stipulated in Schedule Item 148, which price shall include the building and equipment thereof, such as lighting and heating fixtures, plumbing, instrument racks, metal lockers, an approved hospital lock equipped as specified in Section 97, a heating plant, a multicoil hot water heater and boiler, and such other facilities as are shown on the above mentioned drawings, and shall also include such repairs to the building and its equipment as may be necessary during the term of this contract. Furthermore, the Contractor shall provide during the term of this contract, electric light, gas, steam heat, hot and cold running water, compressed air for operating the hospital lock and telephone communication with the working chamber of each caisson and each tunnel heading, payment for which is deemed to be included in the Schedule Item mentioned above. All fixtures, lockers, plumbing, hardware, etc., shall be of such type and make as approved by the Engineer. The construction and equipment of this building shall be completed within four (4) months from the date of the delivery of this contract.

Engineer's
office.

ITEM 155—FENCING.

155-1. The Contractor shall fence the roadway from the land shaft site to Barnum St., as called for in Section 31. Upon the completion of all other work of this contract and during the time of cleaning up the works the Contractor shall build a fence around such openings and in

Fences.

SPECIFICATIONS—FENCING.

such places as the Engineer may direct. These fences are to be tight board fences eight (8) feet high with 6" x 6" posts spaced eight (8) feet on centers, sunk four (4) feet into the ground. The lagging is to be one (1) inch tongued and grooved boards planed on both sides, and surmounted by three (3) strands of approved barbed wire, fastened to steel supports placed as directed by the Engineer. These fences shall be painted on both sides with two (2) coats of approved paint, and such signs are to be painted thereon as may be directed by the Engineer. Gates are to be provided as required and equipped with approved fastenings. Such fencing, including gates, barbed wire and steel supports, will be estimated for payment according to the number of lineal feet of fence actually built and payment therefor will be made at the price stipulated in Schedule Item 155, which price shall be in full compensation for furnishing all material and labor, erecting the fence complete and painting. This Item does not in any way apply to the Contractor's fence around his plant, provided for under Section 22.

PERMIT OF SECRETARY OF WAR.

APPENDIX TO SPECIFICATIONS.

PERMIT OF SECRETARY OF WAR.

U. S. Engineer Office,
First District, N. Y. C.
January 30, 1920.
Permits
578 69.

Whereas, By Section 10 of an act of Congress, approved May 3, 1899, entitled "An Act making appropriations for the construction, repair and preservation of certain public works on rivers and harbors, and for other purposes," it is provided that it shall not be lawful to build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States, outside established harbor lines, or where no harbor lines have been established, except on plans recommended by the Chief of Engineers and authorized by the Secretary of War; and it shall not be lawful to excavate, or fill, or in any manner to alter or modify the course, location, condition, or capacity of, any port, roadstead, haven, harbor, canal, lake, harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War prior to beginning same;

And Whereas, Application has been made to the Secretary of War by the New York State Bridge & Tunnel Commission and the New Jersey Interstate Bridge & Tun-

PERMIT OF SECRETARY OF WAR.

nel Commission, acting conjointly, for authority to construct a traffic tunnel under the Hudson River, New York and New Jersey, from about Canal Street, New York, N. Y., to about Twelfth Street, Jersey City, N. J., the plans for which have been recommended by the Chief of Engineers;

Now Therefore, This is to certify that the Secretary of War hereby authorizes the said work of constructing a traffic tunnel under the Hudson River, New York and New Jersey, from about Canal Street, Manhattan Borough, New York City, N. Y., to about Twelfth Street, Jersey City, N. J., at the location and as shown on the attached plans.*

upon the following conditions:

1. That it is to be understood that this authority does not give any property rights either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to private property or invasion of private rights, or any infringement of Federal, State, or local laws or regulations, nor does it obviate the necessity of obtaining *State assent* to the work authorized. IT MERELY EXPRESSES THE ASSENT OF THE FEDERAL GOVERNMENT SO FAR AS CONCERNS THE PUBLIC RIGHTS OF NAVIGATION. (See *Cummings v. Chicago*, 188 U. S., 410.)

2. That the work shall be subject to the supervision and approval of the District Engineer, Engineer Department at Large, in charge of the locality, who may tem-

*The plans referred to may be seen at the office of the Engineer.

PERMIT OF SECRETARY OF WAR.

porarily suspend the work at any time if, in his judgment, the interests of navigation so require.

3. That if any pipe, wire, pile or cable is herein authorized, it shall be placed and maintained with a clearance not less than that shown by the profile on the plan attached hereto.

4. That so far as any material is dredged in the prosecution of the work herein authorized it shall be removed evenly, and no large refuse piles shall be left. It shall be deposited to the satisfaction of the said District Engineer and in accordance with his prior permission or instructions, either on shore above high water or at such dumping ground as may be designated by him; and where he may so require, within or behind a good and substantial bulkhead or bulkheads, such as will prevent escape of the material into the waterway; and so far as the pipe, wire, or cable is laid in a trench, the formation of permanent ridges across the bed of the waterway shall be avoided and the backfilling shall contain no rock and be so done as not to increase the cost of future dredging for navigation. If the material is to be deposited in the harbor of New York, or in its adjacent or tributary waters, or in Long Island Sound, a permit therefor must be previously obtained from the Supervisor of New York Harbor, Army Building, New York City.

5. That there shall be no unreasonable interference with navigation by the work herein authorized.

6. That if inspection or any other operations by the United States are necessary in the interests of navigation, all expenses connected therewith shall be borne by the permittee.

PERMIT OF SECRETARY OF WAR.

7. That if future operations by the United States require an alteration in the position of the structure or work herein authorized, or if, in the opinion of the Secretary of War, it shall cause unreasonable obstruction to the free navigation of said water, the permittee will be required, upon due notice from the Secretary of War, to remove or alter the structural work or obstructions caused thereby without expense to the United States so as to render navigation reasonably free, easy, and unobstructed; and if, upon the expiration or revocation of this permit, the structure, fill, excavation, or other modification of the watercourse hereby authorized shall not be completed, the permittee shall, without expense to the United States, and to such extent and in such time and manner as the Secretary of War may require, remove all or any portion of the uncompleted structure or fill and restore to its former condition the navigable capacity of the watercourse. No claims shall be made against the United States on account of any such removal or alteration.

8. That if the display of lights and signals on any work hereby authorized is not otherwise provided for by law, such lights and signals as may be prescribed by the Bureau of Lighthouses, Department of Commerce, shall be installed and maintained by and at the expense of the permittee.

9. That the permittee shall notify the said District Engineer at what time the work will be commenced, and as far in advance of the time of commencement as the said District Engineer may specify, and shall also notify him promptly, in writing, of the commencement of work, suspension of work, if for a period of more than one week, resumption of work, and its completion.

PERMIT OF SECRETARY OF WAR.

10. That if the structure or work herein authorized is not completed and written notice of completion is not filed with the aforesaid District Engineer on or before the 31st day of December, 1924, this authorization, if not previously revoked or specifically extended, shall cease and be null and void.

11. That the permittee shall assume all legal liability for any loss or damage due to the construction, maintenance or operation of any of the works and structures, or for loss or damage to any of the work hereby authorized; and said permittee, directly or indirectly, shall make no demand or claim of any kind against the United States or any officer or agent thereof for any loss or damage to the work or structure or to the permittee in the construction, maintenance and operation of the same, caused by any officer or agent of the United States acting under or by virtue of his authority as such; and said permittee shall not attempt in any way to prevent free use by the public of any area outside of that actually covered by the work or structures authorized.

12. That no part of the permanent structure between the pierhead lines along the New York side and along the New Jersey side, as approved by the Secretary of War, shall be above a plane situated fifty (50) feet below mean low water and all temporary structures shall be removed to the same depth.

13. That all floating plant used in the work shall display the signals and marks required by the regulations governing the display of signals on floating plant at work in navigable waters of the United States. These signals shall be displayed continuously until it has been ascertained that the depth of water over all obstructions is

PERMIT OF SECRETARY OF WAR.

not less than the required depth of fifty (50) feet below mean low water and all floating plant, appliances, and anchors have been removed from the site of the work.

14. That, if the tunnels are constructed by the trench method, the construction plant shall not occupy more than seven hundred and fifty (750) feet, consecutively, of the width of the river between pierhead lines at any one time, and work shall be carried on progressively from but one bank.

15. That, during the presence of the plant, appliances, and anchors, or any part thereof, at the site of the work, suitable power boats shall be stationed about one-half mile above the site and about one-half mile below the site, whose duty it shall be to warn all approaching craft of the existence and location of the obstructed area.

16. That no obstruction shall be placed in the river east of a line situated 1,000 feet west of and parallel to the pierhead line along the New York waterfront until the existing 40 feet channel shall have been widened at the expense of the permittee, to such an extent as to provide a channel with a depth of not less than 40 feet at mean low water, and 1,000 feet in width exclusive of the space occupied by the permittee's plant for such distance upstream and downstream from the line of the proposed work as may be directed by the said District Engineer.

17. That the permittee shall, at his expense, cause navigation interests to be notified of the proposed obstruction by publication in at least two prominent local daily papers and in the "Notice to Mariners" of the U. S. Lighthouse Service, as well as by circular letter to all persons, companies, or corporations owning or operating

PERMIT OF SECRETARY OF WAR.

floating plant in New York Harbor and adjacent waters so far as this may be practically possible. If the work of construction is prosecuted intermittently, the notice herein required shall be given, in each instance, a reasonable time in advance of the proposed work.

18. If, during the progress of the work, any plant, machinery, appliance, or material should be sunk, lost, or thrown overboard, or misplaced, which, in the opinion of the said District Engineer, may be dangerous to or obstruct navigation, the permittee shall recover and remove the same with the utmost dispatch.

19. That the temporary blanket on the river bottom adjacent to the New York pierhead line, as indicated on the plans hereto attached, shall be placed only in case the tunnels are constructed by the driven shield method and then not until a satisfactory channel shall have been completed in accordance with the provisions of condition 16 above. No material shall be deposited above a plane 25 feet below mean low water and all material above a plane 50 feet below mean low water shall be removed at the expense of the permittee as soon as the necessity for the temporary protection has, in the opinion of the said District Engineer, ceased to exist.

20. That to insure the removal, without cost to the United States, of the material specified in condition 19, there shall be deposited with the said District Engineer, prior to the placing of any material in the temporary protection, a bond or other satisfactory security in an amount deemed sufficient by him to cover the cost of such removal.

PERMIT OF SECRETARY OF WAR.

21. That if, during the progress of the work, "blow-outs" or other accidents should occur, or be deemed likely to occur, such steps for remedy or prevention may be taken as may be approved by the said District Engineer, upon application of the permittee.

22. That this instrument is issued in lieu of, and supersedes, the one to the New Jersey Interstate Bridge and Tunnel Commission, executed December 8, 1916, which is hereby revoked.

WITNESS my hand this 24th day of January, 1920.

(Signed) NEWTON D. BAKER,
Secretary of War.
H. A. W.

SECURITY TO BE FURNISHED BY THE CONTRACTOR.

CHAPTER V.

SECURITY TO BE FURNISHED BY THE CONTRACTOR.

ARTICLE XXXIV.—Simultaneously with the execution of this contract the Contractor shall give security for the performance of his obligation by filing two bonds, one with the Comptroller of the State of New York, and one with the Chairman of the New Jersey Interstate Bridge and Tunnel Commission, each in the form annexed hereto and entitled "Form of Contractor's Bond," executed by the Contractor and by two or more sureties to be corporations or persons approved by the Commissions, and the bond to the State of New York shall be in the sum of one million dollars (\$1,000,000) and the bond to the New Jersey Interstate Bridge and Tunnel Commission shall be in the sum of one million dollars (\$1,000,000). The execution of these bonds must be duly proved before their delivery in the form essential to proof to entitle a deed to record in the State of New York or in the State of New Jersey and full affidavits of justification of the sureties must be added. In case any of the sureties upon the bonds shall become insolvent or unable in the opinion of the Commissions to pay promptly the amount of such bonds to the extent to which such surety might be liable, then the Contractor within ten (10) days after notice by the Commissions to the Contractor shall, by supplemental bonds or otherwise, substitute another and sufficient surety approved by the Commissions in place of the surety so insolvent or unable. If the Contractor shall fail within such ten (10) days or such further time, if any, as the Commissions may grant to substitute another and sufficient surety, then the Contractor shall, if the Commissions so elect, be deemed to be in default in the performance of his obligations hereunder and upon the said bonds, and the Commissions

Contractor's
bond.

SECURITY TO BE FURNISHED BY THE CONTRACTOR.

in addition to any and all other remedies may terminate this contract or may bring any proper suit or proceeding against the Contractor and the sureties or either of them or may deduct from any moneys then due or which thereafter may become due to the Contractor under this contract the amount for which the surety insolvent or unable as aforesaid shall have justified on the bonds, and the moneys so deducted shall be held by the Commissions as collateral security for the performance of the condition of the bonds.

Retained
percentage
may be held
pending satis-
faction of
claims.

ARTICLE XXXVIII.—If at any time when the Contractor shall otherwise be entitled to the payment of all or a part of the retained percentage provided for under Article XL, there shall be pending any claim for injury or alleged injury to person or property occurring or alleged to have occurred on account of the work hereunder, whether by reason of the negligence, fault or default of the Contractor or otherwise or any claim or infringement or alleged infringement of patents or any claim resulting from the non-payment of labor or material or any other claim on account of any neglect, fault or default or alleged neglect, fault or default of the Contractor including any claim mentioned in Article LIII for which it shall be claimed that the States or the Commissions or either of them shall be liable, then and in that event the said deposit, bonds or retained percentage, including all interest, dividends and other income thereafter accruing thereon, or such part thereof as the Commission may prescribe shall, upon the requirement of either Commission, be reserved by the said Comptroller or the said Chairman, as the case may be, as security against such claims for a time not exceeding the time when such claims would be legally

SECURITY TO BE FURNISHED BY THE CONTRACTOR.

barred. If and when the liability of the States or the Commissions or either of them on such claim or claims shall have been established by a judgment of a court of competent jurisdiction or such claim or claims shall have been admitted by the Contractor to be valid, the amount of such claim or claims may be deducted from the said retained percentage, before payment thereof shall be made to the Contractor.

ARTICLE XL.—In addition there shall be deducted, as hereinafter provided, ten per centum (10%) of the amounts certified from time to time to be due to the Contractor, until the amount so deducted shall reach a total of five hundred thousand dollars (\$500,000) which shall be held as further security for the faithful performance by the Contractor of all the conditions, covenants and requirements specified and provided for in this contract. This ten per centum (10%) deduction, however, shall not be applied to payments made to the Contractor on plant.

Retained
percentages.

When the Engineer shall certify to the Commissions that all tunnel lining has been erected, including permanent connections of this lining at the cross passage and shafts, and either such connections or bulkheads are in place at both ends of the contract and shall also certify that the cross passage has been completed, and that all compressed air has been removed, then one-half ($\frac{1}{2}$) this retained percentage, to wit: two hundred fifty thousand dollars (\$250,000) shall be paid to the Contractor, the other one-half ($\frac{1}{2}$) being retained by the Commissions until the completion of the contract. The payment of the retained percentage at any time shall be subject to the provisions of Article XXXVIII. The Contractor may from time to time withdraw portions of the amounts so retained upon.

SECURITY TO BE FURNISHED BY THE CONTRACTOR.

depositing with the Comptroller or Comptrollers bonds or other acceptable securities which are lawful for the investment of funds of savings banks within the State of New York or the State of New Jersey, as the case may be, and shall be approved by the Commissions. All securities when deposited must be payable to, or run in favor of or be transferred to the Comptroller of the State of New York or the Chairman of the New Jersey Interstate Bridge and Tunnel Commission, as the case may be. In case any of the securities so deposited shall, in the opinion of the Commission in question at any time cease to be of the character of securities which are lawful for the investment of the funds of the savings banks within the State of New York or the State of New Jersey, as the case may be, or shall in the opinion of the Commissions, or either of them, as the case may be, at any time become of less value than the value stated for it or them in the said schedule, then within ten (10) days after notice to the Contractor of the objection of the Commission the Contractor shall either substitute therefor securities which shall be approved by the Commission as of the character aforesaid and as being of at least the value of the former securities to which the Commission shall have objected as such value was originally stated in the said schedule or shall deposit with the Comptroller of the State of New York or the Chairman of the New Jersey Interstate Bridge and Tunnel Commission, as the case may be, in cash the amount of such value of such former securities as so originally stated. In case the Contractor shall not within said ten (10) days or such further time, if any, as the Commission may grant substitute such new securities or make such deposit of cash the Commission may require the Comptroller to deduct from any moneys then due or which thereafter may become due to the Contractor under this contract the amount of the original valuation of such securities objected to; and the Com-

PAYMENTS TO CONTRACTOR.

mission shall hold the moneys so deducted in lieu of such securities as if part of the original deposit as aforesaid. The securities so objected to shall upon such substitution of securities or deposit of cash in lieu thereof be returned to the Contractor.

The Comptroller of the State of New York and the Chairman of the New Jersey Interstate Bridge and Tunnel Commission shall from time to time collect all interest, dividends and other income on any securities deposited by the Contractor and shall pay the same when and as collected, to the Contractor. If the securities are in the form of coupon bonds, the coupons as they respectively become due shall be delivered to the Contractor. Said bonds or securities shall be subject to the same provisions as the retained percentage, and in case of the return of a part of said percentage, the Contractor, at his option, may take portions of retained percentage or of bonds and securities as he desires.

CHAPTER VI.

PAYMENTS TO CONTRACTOR.

ARTICLE XLI.—In order to assist the Contractor to prosecute the work advantageously, the Engineer shall, from time to time, as the work progresses but not more than once a month, make in writing an estimate, such as in his opinion shall be just and fair, of the amount and value of the work done and materials furnished by the Contractor according to the terms of this contract, provided, however, that estimates may at any time be withheld or reduced, if in the opinion of the Engineer, the work is not proceeding in accordance with this contract,

Partial
payments.

PAYMENTS TO CONTRACTOR.

or the Contractor is not complying with all of his obligations thereunder. The first such estimate shall be of the amount and value of the work done and materials furnished since the Contractor commenced the performance of this contract on his part. Every subsequent estimate except the final estimate shall be of the amount and value of the work done and materials furnished since the last preceding estimate was made, provided, however, that no such estimate shall be required to be made when, in the judgment of the Engineer, the total value of the work done and materials furnished since the last preceding estimate amounts to less than twenty-five thousand dollars (\$25,000). The Engineer shall further include accepted steel and cast-iron, including tunnel lining, delivered on the site of the work or on property owned or leased by the States, but not incorporated in the work, at the rate of seventy-five dollars (\$75) per ton of steel so delivered, at the rate of sixty dollars (\$60) per ton of cast steel so delivered, and at the rate of thirty-five dollars (\$35) per ton of cast-iron so delivered. Any material included in a partial estimate which may subsequently become lost, damaged or unsatisfactory shall be deducted from succeeding partial estimates. All such steel and cast-iron so accepted shall be and become the property of the States and the Contractor at his own expense shall promptly execute, acknowledge and deliver or cause to be executed, acknowledged and delivered to the Commissions for any and all such steel and cast iron included in any such partial estimate, proper bills of sale or other instruments in writing in a form and as required by the Commissions from the Contractor and from any person, firm or corporation manufacturing for, or selling or shipping or delivering to, the Contractor any such steel or castiron conveying and assuring to the States title to such steel and cast-iron included in such estimate free from all liens and encumbrances, and containing the further assurances that the manufacturer has been paid for the material, or that

PAYMENTS TO CONTRACTOR.

satisfactory arrangements for such payment have been made, and the Contractor at his own expense shall mark such steel and cast-iron as the property of the States and shall take such other steps, if any, as the Commissions may require or regard as necessary to vest title in the States to such steel and castiron free from all liens and encumbrances. No materials not incorporated in the work, excepting such steel and castiron shall be included in any estimate.

In addition to the ten per centum (10%) retained, as provided for under Article XL, there will be deducted from each estimate following the last payment for plant, eight per centum (8%) of the total amount of such estimate to apply on the payment made to the Contractor for plant, until the amount so deducted shall equal the amount paid by the Commissions for plant.

In case the seven hundred thousand dollars (\$700,000) paid for plant has not all been deducted from the estimates by the time all tunnel lining is completed and all compressed air removed, the balance of the seven hundred thousand dollars (\$700,000) will be deducted from the next partial estimate, or succeeding estimates as the case may require.

ARTICLE XLII.—Partial estimates shall not be required to be made by strict measurement, but they may be made by measurement or by estimation, or partly by one method and partly by the other, and it shall be sufficient if they are approximate only.

Not by strict
measurement.

ARTICLE XLIII.—When each partial estimate is made and certified by the Engineer in writing to the Commissions, the respective Commissions shall prepare and certify one voucher each for forty-five per centum (45%) of the amount stated in such estimate or certificate of the value of the work done and

Vouchers.

PAYMENTS TO CONTRACTOR.

materials furnished, each Commission retaining five per centum (5%) of each partial estimate. After the amount so retained by both Commissions reaches a total of five hundred thousand dollars (\$500,000), this deduction from the estimate will be discontinued and thereafter the Commissions will prepare and certify one voucher each for fifty per centum (50%) of the amount stated in each estimate or certificate.

In addition to the above, after the Engineer shall certify in writing to the Commissions that all plant is completely installed as set forth in Article LVIII and the Commissions shall have caused to be paid to the Contractor the total amount for plant, the Commissions shall then make a further deduction of eight per centum (8%) [four per centum (4%) by each Commission] of the partial estimates until the amount so deducted equals the amount paid by the Commissions for plant. If, at the time of the completion of all tunnel lining and the removal of all compressed air, there remains a balance still to be deducted for plant payment, the entire balance becomes due at that time, and will be taken from the next partial estimate, or succeeding estimates as the case may require.

The States, or either of their Commissions, may at all times reserve and retain from said partial estimates or any of them, in addition to all deductions above-mentioned, any sum or sums which, by the terms hereof or of any law of the State of New York or the State of New Jersey, is or may be authorized to be reserved or to be retained, and the States shall, within thirty (30) days after the date of the certification of such vouchers by the Commissions, pay the same.

Final payment.

ARTICLE XLIV.—Whenever, in the opinion of the Engineer, the Contractor shall have completely performed this contract on his part and no further work shall be required of him hereunder, the Engineer shall so certify

PAYMENTS TO CONTRACTOR.

in writing to the Commissions and in his certificate shall state from actual measurements the whole amount of the work done by the Contractor and also the value of such work under and according to the terms of this contract. On the expiration of forty (40) days after the acceptance by the Commissions of the work herein agreed to be done by the Contractor and the filing of a certificate of the completion and acceptance of the work in the office of the Commissions, signed by the Engineer and the Chairman of each Commission, the Commissions shall cause to be paid to the Contractor the amount remaining after deducting from the amount stated in the last mentioned certificate all such sums as shall heretofore have been paid to the Contractor under any of the provisions of this contract and also any sum or all such sums of money as by the terms hereof the States are or may be authorized or required to reserve or retain; provided, that nothing herein contained shall be construed to affect the right, hereby reserved, of the Commissions to reject the whole or any portion of the aforesaid work, should the said certificate be found or known to be inconsistent with the terms of this contract or otherwise improperly given. All prior certificates upon which partial payments may have been made, being merely estimates, shall be subject to correction in the final certificate, which final certificate may be made without notice thereof to the Contractor or of the measurements upon which it is based.

ARTICLE XLV.—If the payment of the amount due the Contractor on any voucher shall be delayed beyond the time stipulated in Article XLIII in the case of partial payment, or Article XLIV in the case of final payment, the State whose voucher is delayed shall pay the Contractor interest on such amount at the rate of six per centum (6%) per annum for the period of such delay; it

Interest on
delayed
payments.

PAYMENTS TO CONTRACTOR.

being understood that such payments of interest, if any, are to be in lieu of any claim of the Contractor for alleged damages for breach of contract or otherwise in case of delayed payments. The term for which interest shall be paid shall be reckoned, in the case of a partial payment from the thirtieth day after the certification of such voucher by the Commissions, and in the case of a final payment from the fortieth day after the acceptance of the work by the Commissions to date of payment of the voucher. The date of payment of a voucher shall be considered the day on which the voucher is ready for payment as evidenced by the records of the Comptrollers of the State of New York and the State of New Jersey. If interest shall become due on any partial payment, the amount thereof shall be added to a succeeding payment by the Commission delaying such payment. If interest shall become due on a final payment, the amount thereof shall be paid on a supplementary voucher prepared by the Commission delaying such payment.

No estoppel.

ARTICLE XLVI.—The States shall not nor shall any department or officer thereof be precluded or estopped by any return or certificate made or given by the Commissions, any Engineer or other officer, agent or appointee thereof under any provision of this contract from at any time either before or after the final completion and acceptance of the work and payment thereof pursuant to any such return or certificate showing the true and correct amount, quality and character of the work done and materials furnished by the Contractor or any other person under this agreement or from showing at any time that any such return or certificate is untrue and incorrect or improperly made in any particular or that the work and materials or any part thereof do not in fact conform to the specifications; and the States shall

PAYMENTS TO CONTRACTOR.

not be precluded or estopped, notwithstanding any such return or certificate and payment in accordance therewith, from demanding and recovering from the Contractor such damages as they may sustain by reason of his failure to comply with this contract or the specifications.

ARTICLE XLVII.—Neither the acceptance by the Commissions or their Engineer or any of their employees nor any order, measurement or certificate by the Engineer, nor any order by the Commissions for payment of money nor any payment for, nor acceptance of, the whole or any part of the work by the Engineer or the Commissions, nor any extension of time nor any possession taken by the Commissions or their employees shall operate as a waiver of any portion of this contract or of any power herein reserved to the Commissions or of any right to damages herein provided; nor shall any waiver of any breach of this contract be held to be a waiver of any other or subsequent breach.

No waiver.

ARTICLE XLVIII.—The acceptance by the Contractor of the last payment aforesaid shall be and shall operate as a release to the States from all claim and liability to the Contractor for anything done or furnished for, or relating to, the work; or for any act of neglect of the Commissions, the States or of any person relating to or affecting the work, except only the claim against the States for the remainder, if any there be, of the amounts kept or retained as provided in this contract.

Final payment
to terminate
liability of
States.

ARTICLE XLIX.—If the Contractor shall claim compensation for any damage sustained by reason of any act or neglect of the States or the Commissions or their agents, he shall, within ten (10) days after the sustaining of such damage, make a written statement to the Engineer of

Contractor's
claim for
damage.

PAYMENTS TO CONTRACTOR.

the nature of the damage sustained. On or before the fifteenth day of the month succeeding that in which any such damage shall have been sustained the Contractor shall file with the Engineer an itemized statement of the details and amount of such damage, and, unless such statement shall be made as thus required, his claim for compensation may in the discretion of the Commissions be forfeited and invalidated and he shall not be entitled to payment on account of any such damage.

CONTRACTOR'S LIABILITY FOR INJURIES.

CHAPTER VII.

CONTRACTOR'S LIABILITY FOR INJURIES TO PERSONS OR PROPERTY.

ARTICLE L.—The Contractor expressly admits and covenants to and with the States that the specifications and other provisions of this contract, if the work be done without fault or negligence on the part of the Contractor, do not involve any damage to surface, sub-surface or overhead structures, foundations, bulkheads, piers, walls or other parts of adjacent or abutting buildings; and the Contractor will at his own expense make good any damage that shall, in the performance of the work, be done to surface, sub-surface or overhead structures, foundations, bulkheads, piers, walls or other parts of adjacent or abutting buildings. The liability of the Contractor under this covenant is absolute and is not dependent upon any question of negligence on his part or on the part of his agents, servants or employees, and the neglect of the Engineer to direct the Contractor to take any particular precautions or to refrain from doing any particular thing shall not excuse the Contractor in case of any such damage.

Contractor's
liability for
damages.

It is the intention of the parties to this contract that, in addition to indemnifying the States against all claims for damages, the Contractor shall also be liable to the owners of adjacent or abutting property, buildings or structures and to all tenants or occupants of such buildings or structures for all physical injuries to property or person which may be occasioned by the work of the construction, even in cases where such owners, tenants or occupants have no legal claim against the States for such injuries.

CONTRACTOR'S LIABILITY FOR INJURIES.

Maintenance
of traffic.

ARTICLE LI.—The Contractor shall during the performance of the work safely maintain the traffic on streets, avenues, highways, parks, waters and other public places and shall take all necessary precautions and place proper guards for the prevention of accidents and shall put up and keep at night suitable and sufficient lights.

Indemnifica-
tion for
accidents.

ARTICLE LII.—The Contractor shall be solely responsible for all physical injuries to person or property occurring on account of the work hereunder and shall indemnify and save harmless the States from liability upon any and all claims for damages on account of such injuries to person or property and from all costs and expenses in suits which may be brought against the States for such injuries to person or property; it being distinctly understood, stipulated and agreed that the Contractor shall be solely responsible and liable for and shall fully protect and indemnify the States against all claims for damages to person or property occasioned by or resulting from the methods or process of doing the work, whether such damages be attributable to negligence of the Contractor, of his employees or otherwise.

Money due
Contractor may
be retained to
meet claims.

ARTICLE LIII.—In case any claim shall be made by any person or corporation against the Contractor or the States for injury or alleged injury to person or property occurring or alleged to have occurred on account of the work hereunder, whether by reason of the negligence, fault or default of the Contractor or otherwise, or for any infringement or alleged infringement of patents or for any neglect, fault or default or alleged neglect, fault or default of the Contractor, the amount of such claim or so much thereof as the Commissions may deem reasonable shall, upon the requirement and in the discretion

CONTRACTOR'S LIABILITY FOR INJURIES.

of the Commissions, be retained by the Commissions out of any moneys then due or thereafter growing due to the Contractor hereunder (in addition to the other sums herein authorized to be so retained) as security for the payment of such claim or claims. If and when the liability of the States or the Contractor on such claim or claims shall have been established by a judgment of a court of competent jurisdiction or such claim or claims shall have been admitted by the Contractor to be valid, the said claim or claims may be paid from the amount so retained and the balance, if any, paid to the Contractor. Should there be any unsatisfied claim or claims for injury or alleged injury to person or property occurring or alleged to have occurred on account of the work hereunder, whether by reason of the negligence, fault or default of the Contractor or otherwise, or for any infringement or alleged infringement of patents or for any neglect, fault or default of the Contractor, at the time when the final voucher for the work is prepared and certified, the Commissions shall have the right to retain out of the final payment and to deduct from the amount of the final voucher a sum in their judgment sufficient to protect the States in regard to all unsatisfied claims as aforesaid, and in case the amount thus retained should be insufficient to pay the amount adjudicated to be due upon such claim or claims, the States may sue for and recover from the Contractor the amount or balance as a debt from the Contractor to the States. The Commissions may further, if in their judgment such a course is necessary or proper, at the time of preparing and certifying the final voucher and as a condition of preparing and certifying the same, require the Contractor to continue his bond or deposit or any part thereof as security against any such unsatisfied claims for a time not exceeding the time when such claim would be legally barred.

CONTRACTOR'S LIABILITY FOR INJURIES.

Examination of
property.

ARTICLE LIV.—The Engineer shall cause a detailed examination of all adjacent, abutting or overhead property to be made before construction is begun. The owner or tenant of each parcel or his or their duly authorized representative shall be invited, whenever such examination is made, to be present by a notice in writing delivered to a person apparently in charge of the premises, and the Contractor or his duly authorized representative shall attend and with the Engineer shall make such detailed examination. A complete record of the existing conditions of each parcel shall be made in quadruplicate, signed by the Engineer and the Contractor; one record shall be retained by the owner, one by the Contractor and two by the Commissions. At such times as the Engineer may direct and upon the completion of the work or upon notice to the Engineer by the owner or tenant that physical injury has occurred, further examination shall be made and the findings recorded and filed as above.

Damage to
Works during
construction.

ARTICLE LV.—All risk of loss or damage to the Works or to any part thereof or to any of the materials, plant, tools, appliances, supplies or other things used in doing the work prior to final completion is assumed and shall be borne by the Contractor, and any such loss or damage shall be made good by the Contractor at his own cost, and the work shall be carried forward by him in accordance with this contract without additional cost to the States by reason of such loss or damage.

Claim for
infringement of
patents.

ARTICLE LVI.—The Contractor shall be responsible for any claims made against the States for any infringements of patents by the use of patented tools, articles or appliances in the performance or completion of the work, or by the use of any materials, process or method connected with the work, and he shall save harmless and indemnify the States from and against all costs, expenses and damages which the States shall be obliged to pay by reason of any such use or infringement.

INTERFERENCE BY INJUNCTION: PLANT SITES.

CHAPTER VIII.

STATES TO SECURE CONTRACTOR AGAINST INTERFERENCE
BY INJUNCTIONS. PROVISION FOR PLANT SITES.
PAYMENT FOR AND OWNERSHIP OF PLANT.

ARTICLE LVII.—The Commissions hereby stipulate and covenant to and with the Contractor that they will use their best endeavor to secure and assure to the Contractor, so long as the Contractor shall perform the stipulations of this contract, the right to construct the Tunnel as prescribed in this contract, free of all right, claim or other interference, whether by injunction, suit for damages or otherwise on the part of any owner, abutting owner or other person; but not including any interference, legal or otherwise, by patentees or persons claiming to be patentees of tools, methods or appliances.

Right of
Contractor
to perform
stipulations
of contract.

ARTICLE LVIII.—The Commissions will provide for the Contractor, without cost to him therefor, sites for his plant and for the receipt, storage and disposal of materials, and for a roadway, indicated as Parcels "A", 21, 22, 23, 24, 26, 28, 34, "B", and "C", as shown on Contract Drawing No. 39. These parcels shall be used solely for the purpose of constructing the Vehicular Tunnel and the said sites or parcels, or any of them as the Contractor may require, shall be turned over to him upon his requisition therefor as herein provided.

Plant sites.

The Commissions are in possession of all of the parcels enumerated in this Contract (with the exception of Parcels A and B) under the provisions of an Agreement between the Commissions and the Erie Railroad Company, dated December 7, 1921. This Agreement provides, among other things, the manner in which such parcels may be occupied and the work under this Contract performed

PLANT SITES.

thereon or therein and the protection or insurance required against injury to persons or damage to this or other property of the Erie Railroad Company. The Contractor admits that he has informed himself of the obligations of the Commissions under the terms of the said Agreement and he does assume for and on behalf of the Commissions all such obligations to the full extent of the Commissions' liability thereunder, it being the intent of this Contract that every obligation assumed by the Commissions with respect to the occupancy of the said property of the Erie Railroad Company and the manner of the performance of the work thereunder shall be assumed by the Contractor as a part of this Contract.

Copies of the said Erie Agreement are on file in the office of the Commissions and may be obtained upon application.

At the time of making requisition for any of these parcels, the Contractor shall submit for the approval of the Engineer, drawings showing the character and extent of the proposed occupation and use of plant to be placed thereon.

Parcel "A" will be made available to the Contractor as a site for his power plant and storage of materials within thirty (30) days after requisition therefor and upon its delivery to the Contractor, all buildings, structures and equipment thereon shall become his property and he shall remove and dispose of the same at his own expense. In clearing this property, the Contractor shall safeguard the walls, foundations and other parts of structures of adjacent property and shall shore and support the same and do such other work as may be necessitated by the work of removal of the temporary supports and he shall put the same in a good and serviceable condition, including painting, plastering, bricking up openings and waterproofing where necessary. The use of this parcel will be allowed during the period of this contract.

Parcels 21, 22, 23, 24, 26, 28, 34 and "C" will be made available to the Contractor for the purpose of carrying

PLANT SITES.

out the work under this contract within thirty (30) days after requisition therefor. With the exception of Parcel 22, they will be cleared by the Commissions of all surface structures, except the railroad tracks serving Pier No. 9, the railroad track serving the Union Terminal Cold Storage Warehouse, poles carrying wires, cables, hydrants and sub-surface structures. The Contractor shall furnish such protection to remaining and adjacent structures as is provided for in Section 55.

In Parcel 22 there is included the use of the northerly eighteen (18) feet of the sub-structure of Pier No. 9. The Contractor shall assume responsibility for any damage, due to his operations, to the sub-structure, or any part of this pier and shall leave it in as good condition at the completion of the work as it was at the beginning.

Parcels 21, 22 and "C" will be available for the Contractor's use for thirty-six (36) months after the delivery of the contract, Parcels 23 and 24 for one (1) year and two (2) months following the period that Parcel 26 is available and Parcel 26 is available for the Contractor's use for ten (10) months and two (2) weeks from the time it is turned over to the Contractor. Parcel 28, which provides an overhead easement at elevation 325.00, will be available for two (2) years and two (2) weeks, the term of this occupancy to start the same time as that of Parcels 23 and 24. At the expiration of the Contractor's occupancy of these parcels, he shall restore the surface of the ground to its original condition.

After the clearing of the sites by the Commissions, all work necessary to make these parcels available for the Contractor's use shall be at his expense and there shall be no charge to him for his occupancy thereof. In case the Contractor shall desire to continue in possession of the above mentioned parcels for a longer period of time than above specified and in the opinion of the Commissions such possession is reasonable and deemed necessary for the completion of the work, then the Contractor shall

PLANT SITES.

pay and the Commissions shall accept, as full payment for rental for such continued possession, the respective sums specified in the following schedule for each day, including Sundays and holidays, for each respective parcel:

Parcel 21	Ten dollars (\$10) per day.
“ 22	Seventy dollars (\$70) per day.
“ 23 and 24	Ten dollars (\$10) each per day.
“ 26	One hundred dollars (\$100) per day.
“ 28	Five dollars (\$5) per day.

The use of Parcel “B” will be allowed for a period of thirty-six (36) months from the date of the delivery of the contract and will be turned over to the Contractor within thirty (30) days after requisition is made for it. The Commissions will clear this parcel of all surface structures without expense to the Contractor. If the Contractor shall require this parcel for a longer period of time than above stated and in the opinion of the Commissions its further use is reasonable and necessary for the completion of the work, then the Contractor shall pay and the Commissions shall accept as full payment for rental the sum of five dollars (\$5.00) for each day, including Sundays and holidays, for such continued possession.

The Contractor will be required to carry on his work in connection with the construction of the Vehicular Tunnel in compliance with the agreement between the Erie Railroad Company and the Commissioners dated December 7th, 1921. This agreement is made a part of this contract. Copies of the said agreement are on file in the office of the Commissions and may be obtained upon application.

The right to the possession and use of the aforesaid parcels which are granted to the Contractor herein shall be subject to such rights therein and thereto as the Com-

PLANT SITES.

missions may hereunder desire to grant to other contractors under subsequent contracts for the construction of the Vehicular Tunnel. Such rights as may hereunder be granted to other and subsequent contractors however shall not unduly interfere with or preclude satisfactory progress of the work under this contract.

In the event of a default by the Contractor hereunder he shall forthwith surrender possession of the parcels herein enumerated to the Commissions without the necessity of legal or other proceedings therefor and promptly upon receipt of a notice of default given as herein provided.

At the commencement of the period of occupancy of the said parcels a joint survey of their condition shall be made by the Contractor and the Engineer and a proper record thereof kept by each and at the completion of the work hereunder or at the time of default, if any, another joint survey shall be made by the Contractor and the Engineer, which said survey shall determine the work of restoration which is to be done by the Contractor. Before making alterations in the physical structures on any of the parcels the Contractor shall submit to the Engineer, for his approval, the plans for such alterations.

The Commissions will provide payment for power plant as defined in Sections 88 to 93 inclusive and payment for shields as defined in Section 8-1, when such power plant or shields are delivered and erected upon the work. Such payment will be made in partial estimates from time to time upon the certification of the Engineer that such plant is delivered and installed. The total payment for power plant shall be two hundred fifty thousand dollars (\$250,000), and the total payment for shields four hundred fifty thousand dollars (\$450,000), [two hundred fifty thousand dollars (\$250,000) to be paid as soon as two (2) shields are built and in operation, one hundred thou-

Payment
for plant.

PLANT SITES.

sand dollars (\$100,000) when the third shield is built and in operation and one hundred thousand dollars (\$100,000) when the fourth shield is built and in operation]. The total payment will not be made until the power plant is in working condition and until the shields are in working operation. Eight per centum (8%) of the amounts certified from time to time to be due to the Contractor will be retained until the amounts so retained equal the entire amount paid to the Contractor for plant has been deducted. A deduction of eight per centum (8%) will be made on the first partial estimate after the last payment for plant has been made, and like deduction will be made on each succeeding partial estimate until the amount paid to the Contractor for plant has been entirely deducted. If at the time of the completion of all tunnel lining and the removal of all compressed air, there still remains a balance to be deducted for plant, payment of the entire balance becomes due at that time and will be deducted from the next partial estimate, or succeeding estimates as the case may require.

Ownership
of plant.

All the plant, materials, tools, appliances, equipment, supplies and property provided by the Contractor for his use in or for the construction or maintenance of the work shall, as soon as placed in or upon the work or the site of the work, absolutely be and become the property of the Commissions and no part of such plant, materials, tools, appliances, equipment, supplies or property shall be removed from the work or the site of the work without the previous permission of the Engineer except as hereinafter in this Article provided, but the Contractor shall have the right to use the same for the purpose of his work and he shall keep the same in good repair. If the Contractor shall with the previous permission of the

PLANT SITES.

Engineer so remove any part of the plant or any other such material or thing so provided by the Contractor, the title to the same shall upon such removal revert in the Contractor. If the Engineer shall at any time certify to the Commissions that the plant or any part thereof or any other such material or thing provided by the Contractor and remaining on the work or the site of the work is no longer required for the performance of the work and may be removed without danger or injury to the Tunnel, the Commissions shall have the right to require the Contractor to remove and take away the same forthwith at the Contractor's expense, and the title to the same shall upon such removal revert in the Contractor. And whenever the Contractor shall have fully completed the Works according to the terms of this contract and the Commissions shall so certify, the Contractor shall remove any such plant and any other such material or thing so provided by the Contractor and then remaining on the work which in the opinion of the Commissions may be removed without danger or injury to the Tunnel and the title to the same shall upon such removal revert in the Contractor. If the Contractor shall be declared by the Commissions to be in default as provided in Article LXVIII, the Contractor shall forthwith surrender and deliver to the Commissions, according to the requirement of the Commissions, any or all of the materials, plant, tools, appliances, equipment, supplies and property provided by the Contractor for the purpose of his work and the Commissions, its contractors and agents, shall have the right to take possession of and use the same as the property of the Commissions without liability for waste or destruction thereof and without the obligation to account therefor; and in case this contract shall be declared at an end by the Commissions as provided in Article LXVIII the Contractor shall forthwith surrender and deliver to the

Removal of
plant.

Surrender of
plant in case
of default.

PLANT SITES.

Commissions all the materials, plant, tools, appliances, equipment, supplies and property provided by the Contractor for the purpose of his work and the Commissions, its contractors and agents, shall have the right to take possession of and use the same as the property of the Commissions without liability for waste or destruction thereof and without the obligation to account therefor; subject only to the condition that whenever the Tunnel, which the Contractor herein agrees to construct with its appurtenances and the other work which the Contractor herein agrees to perform shall have been completed, the Commissions, if they shall be of opinion that any plant, materials, tools, appliances, equipment, supplies or property so provided and placed by the Contractor and then remaining (if there be any) shall no longer be necessary for the construction of said portion of said Tunnel or the performance of such other work and may be removed without danger or injury to said Tunnel, shall by resolution so declare and shall give notice of its finding to the Contractor and the Contractor within thirty (30) days after such notice, provided that he shall have first paid to the Commissions all sums owed by him to the Commissions, may remove such plant, materials, tools, appliances, equipment, supplies or property so provided and placed and then remaining which in the opinion of the Commissions is no longer necessary and may be removed as aforesaid, in such condition as the same may then be, and the title to such plant, materials, tools, appliances, equipment, supplies or property, in such condition as the same may then be, shall upon the removal of all such plant and other materials and things revert in the Contractor; but if the Contractor shall fail to remove all such plant and other materials and things as aforesaid, title shall remain in the Commissions.

PLANT SITES.

For the further assurance of the faithful performance of this Article the Contractor will from time to time, upon the demand of the Commissions, execute such further instruments, writings or assurances as may be necessary for the effectual performance of the intent of this Article. The form and substance of such instruments, writings or assurances shall be determined by the Commissions.

ARTICLE LIX.—At the time of the letting of the contract, or before any payment shall be due to the Contractor, or at any time during the course of operation, the Contractor shall satisfy the Commissions of his ownership of the plant, materials, tools, appliances, equipment, supplies or property, or any part thereof, referred to herein, and if the Commissions so order, no moneys shall be due him hereunder until all liens or incumbrances on the said plant, materials, tools, appliances, equipment, supplies or property, or any part thereof, which tend in any way to limit or reduce the ownership of the Commissions therein shall have been satisfied.

No liens on
Contractor's
plant.

ARTICLE LX.—If the Contractor shall furnish other sites in addition to those provided pursuant to the provisions of Article LVIII for the installation or maintenance of air compressing plant, or auxiliary machinery, then and in that event, in order to secure and assure to the Commissions free and clear title to, and full control of, all plant, materials, tools, appliances, equipment, supplies and property provided by the Contractor for his use in or for the construction or maintenance of the work and placed in or upon any such site, the Contractor shall lease, or procure a lease, free from encumbrances, to the Commissions, of all such sites provided by the Contractor, such lease to be in such form and to contain such provisions (including provisions for the protection and indemnification by the Contractor of the States, and the Com-

Contractor's
plant on prop-
erty other than
provided for in
this Contract.

PLANT SITES.

missions and the members of the Commissions against claims by reason of such lease or by reason of anything done or permitted in or upon the leased sites) as the Commissions may require, the term of such lease to be for such period as the Commissions may deem necessary for the completion of the Works and the rental for the full term to be the sum of one dollar. The Contractor shall also take such other steps, if any, as the Commissions may in their discretion require for the purpose of securing and assuring to the Commissions free and clear title to all such plant, materials, tools, appliances, equipment, supplies and property provided or placed upon such sites and for the purpose of securing and assuring to the Commissions the control thereof, particularly the right to take possession of and use the same in the event that the Commissions shall declare the Contractor to be in default or declare this contract at an end as provided in Article LXVIII. In case the Commissions shall declare the Contractor to be in default as provided in Article LXVIII, and shall demand possession of any of said sites or any part thereof, the Contractor shall forthwith quit and surrender said sites or such part thereof; and in case the Commissions shall declare this contract at an end, as provided in Article LXVIII, the Contractor shall forthwith quit and surrender said sites. In case the Contractor shall fail to quit and surrender any of said sites or any part thereof when required so to do, the Commissions in addition to all other remedies, shall have the right to remove the Contractor from said sites or such part thereof and to charge the expense of such removal to the Contractor and to deduct such expense from any moneys then due or thereafter becoming due to the Contractor hereunder. And neither the Commissions nor any member of the Commissions nor the Engineer or any of his assistants or subordinates shall be liable for any damage resulting to the Contractor from such removal, whether occasioned by negligence in the manner of removal or otherwise.

TIME FOR COMPLETION: DAMAGES FOR DELAYS, ETC.

CHAPTER IX.

TIME FOR COMPLETION, DAMAGES FOR DELAY, ETC.

ARTICLE LXI.—Time is of the essence of this contract. The Contractor shall begin actual work within sixty (60) days after the date of the delivery of the contract and shall thenceforth prosecute the work continuously and diligently. The entire work covered by this contract shall be completed in all respects within thirty-six (36) months from the date of the delivery of the contract.

Commence-
ment and com-
pletion of work.

ARTICLE LXII.—In the event of delay in completion of any work ordered hereunder beyond the period herein prescribed or beyond the period to which such time may be extended by resolution of the Commissions for good cause shown, the States shall be paid damages for such delay. Inasmuch as the amount of such damages will be extremely difficult to ascertain, especially in view of the fact that the construction of the Tunnel is a part of the construction of the Vehicular Tunnel and that any delay in the construction of said Tunnel may delay the construction and completion of said Vehicular Tunnel, it is hereby expressly agreed that such damages shall be liquidated and paid as follows:

Damage for
delay.

The Contractor shall pay to the States for each and every day, except Sundays and legal holidays, that he shall be in default in completing the entire work to be done under this contract, the sum of one thousand dollars (\$1,000), which sum is hereby agreed upon not as a penalty but as liquidated damages which the States will suffer by reason of such default. The States shall have the right to deduct such amounts from any moneys due or which may thereafter become due to the Contractor under this contract. But in case the Contractor shall be

TIME FOR COMPLETION: DAMAGES FOR DELAYS, ETC.

actually and necessarily delayed by reason of any labor strike not caused or instituted or provoked by the Contractor or by any sub-contractor, agent or representative of the Contractor, or in case the Contractor shall be actually and necessarily delayed by any injunction or by any interference of public authority or by the suspension of the work by the Commissions as provided in Article LXV, and in case the Contractor cannot with reasonable diligence make up for the delay so occasioned by speedier work when the Contractor shall not so be delayed, then the said date for completion shall, except as hereinafter provided, be extended by resolution of the Commissions to a date later than the expiration of the said period of thirty-six (36) months by the amount of the time of such delay as determined by the Commissions.

Commissions
may intervene
in case of
injunctions.

ARTICLE LXIII.—But no injunction, strike or interference of public authority shall be ground for such extension unless and until the Contractor shall give the Commissions notice of the injunction or other cause of delay, with copies of the injunction or other orders and of the papers upon which the same shall have been granted, and no extension shall be granted except for the delay occasioned after the giving of such notice. Nor will any extension be granted in any case unless the Contractor shall prove to the satisfaction of the Commissions all the facts which entitle him to such extension. The Commissions and the States or either shall be accorded the right to intervene or become a party to any suit or proceeding in which any such injunction shall be obtained and to move to dissolve the same or otherwise, as the Commissions or the States may deem proper. If necessary, Counsel to the Commissions shall be authorized by the Contractor to appear for that purpose as counsel or attorneys for him.

TIME FOR COMPLETION: DAMAGES FOR DELAYS, ETC.

ARTICLE LXIV.—The time stipulated within which to complete the Tunnel is based upon the quantities of the various items entering into the work as stated in the Contractor's Proposal, which are given solely for the purpose of classifying bids. In case these quantities are exceeded or diminished, then an extension or diminution of the time for the completion of the Tunnel shall be made. It is, however, understood and agreed that in case an increase in any one item is balanced or offset by diminution of other items, no change in the term shall be made, and in any event the Commissions shall determine the amount of extension or diminution of time in respect of the relative increase or reduction in the quantities involved in the final completion of the Tunnel.

Time for completion may be changed.

ARTICLE LXV.—The Commissions reserve the right of temporarily suspending the execution of the whole or any part of any work ordered to be performed hereunder, if they shall deem it for the interest of the States so to do, without compensation to the Contractor for such suspension other than extending the time for completing the work as hereinbefore provided as much as it may have been delayed by such suspension.

Suspension of work.

ARTICLE LXVI.—Only the actual delay necessarily resulting from one or more of the causes above mentioned shall be ground for extension of time, and in case the Contractor shall be delayed at any time or for any period by two or more of the causes above mentioned, only one period of extension, if any, shall be granted for such delay and the Contractor shall not be entitled to a separate extension for each one of the causes so operating, it being understood that only the actual period of necessary delay, as determined by the Commissions irrespective of

Extensions not cumulative.

REMEDIES IN CASE OF CONTRACTOR'S DEFAULT.

the number of causes contributing to produce such delay, will be ground for extension of time.

Permission to complete contract no waiver.

ARTICLE LXVII.—The permitting of the Contractor to go on and finish the work or any part of it after the time fixed for its completion or after the date to which the time for completion may have been extended, or the making of payments to the Contractor after any of such periods, shall in no wise operate as a waiver on the part of the States of any of their rights under this contract.

CHAPTER X.

REMEDIES IN CASE OF CONTRACTOR'S DEFAULT.

In cases of default.

ARTICLE LXVIII.—If any work to be done under this contract shall be abandoned by the Contractor, or if this contract shall be assigned or the work sublet by him otherwise than as herein specified, or if the Contractor shall not comply with such orders as may from time to time be given by the Commissions or the Engineer with respect to the work, or if the Contractor shall violate any of the provisions or covenants of this contract or of the specifications, or shall not execute the same in good faith and in accordance with the terms hereof, or if at any time the Engineer shall certify in writing to the Commissions that in his opinion suitable and sufficient materials, plant, power, tools, supplies or other means of construction are not provided, or that a sufficient number of workmen are not employed in the execution of the work under this contract, or that in his opinion the work or any part thereof is not being carried on with such skill, diligence and despatch as will insure the completion of the work within the time specified in this contract, or if any work be not fully completed within the time named

REMEDIES IN CASE OF CONTRACTOR'S DEFAULT.

in this contract for its completion or within the period to which the time for completion may be extended by the Commissions or (in view of the necessity for special skill and ample financial resources in the prosecution of the work), if the Contractor shall become insolvent or bankrupt or if his property or affairs shall be put in the hands of a receiver or receivers, then and in any of such cases the Commissions may upon not less than five (5) days' notice to the Contractor or upon such shorter notice as in the opinion of the Commissions may be justified,

(1) Declare the Contractor to be in default; and the Commissions may thereupon notify the Contractor, by a written notice, to discontinue all work or any part thereof under this contract, and thereupon the Contractor shall discontinue the work or such part thereof, and the Commissions shall thereupon have the right, either for the Contractor, for his account and at his risk, or otherwise as the Commissions may determine, to contract for the completion of the Works or such part thereof, either with or without public advertisement, or to place such and so many persons as they may deem advisable, by contract or otherwise, to work and complete the work herein described or such part thereof, to take possession of and use any or all of the materials, plant, tools, appliances, equipment, supplies and property of every kind provided by the Contractor for the purpose of his work, and to procure other materials, plant, tools, appliances, equipment, supplies and property for the completion of the Works or such part thereof, and to charge the expense of said labor and materials, plant, tools, appliances, equipment, supplies and property to the Contractor. The expense so charged may be deducted and paid by the States out of such moneys as may be due or may at any time thereafter grow due to the Contrac-

REMEDIES IN CASE OF CONTRACTOR'S DEFAULT.

tor under and by virtue of this contract. And the Contractor shall, upon the completion of the Works or such part thereof or from time to time during the course of the completion of the Works or such part thereof, as the Commissions may require, forthwith pay to the States, with interest, the excess, if any, of the cost to the States of the completion of the Works or such part thereof over the amount payable to the Contractor for the same work and materials under the terms of this contract. And the completion of the Works or such part thereof by the Commissions shall not release or discharge the Contractor from liability with respect to the remainder of the work or any other obligation or liability hereunder; and when any particular part of the work is being carried on by the Commissions by contract or otherwise, under the provisions of this paragraph (1), the Contractor, unless he shall have been directed to discontinue all work, shall continue the remainder of the work in conformity with the terms of this contract and in such manner as in nowise to hinder or interfere with other contractors of the Commissions or with the persons or workmen employed, as above provided, by the Commissions, by contract or otherwise, to do any part of the work or to complete the same under the provisions of this paragraph. Or

(2) Declare this contract at an end except as to the liability of the Contractor hereinafter in this paragraph provided for; and the Commissions shall thereupon have the right to contract for the completion of the Works, either with or without public advertisement, or to place such and so many persons as they may deem advisable, by contract or otherwise, to work and complete the work herein described, to take possession of and use all the materials, plant, tools, appliances, equipment, supplies

REMEDIES IN CASE OF CONTRACTOR'S DEFAULT.

and property of every kind provided by the Contractor for the performance of his work and to procure other materials, plant, tools, appliances, equipment, supplies and property for the completion of the same. And in case the expense to the States of completing the Works (including the expense of procuring such other materials, plant, tools, appliances, equipment, supplies and property) shall exceed the amount which would have been payable to the Contractor for the same work and materials under this contract if this contract had been completed by the Contractor, he shall, upon the completion of the Works or from time to time during the course of the completion of the Works as the Commissions may require, pay the amount of such excess, with interest, to the States; and in case such expense shall be less than the amount which would have been payable to the Contractor for the same work and materials under this contract if this contract had been completed by the Contractor, he shall forfeit all claim to the difference. And the Contractor shall also pay to the States the amount of any claim for which the States shall be liable for injury to person or property occurring on account of any work done by the Contractor under this contract, whether by reason of the negligence, fault or default of the Contractor or otherwise, or for infringement of patents or for any neglect, fault or default of the Contractor, and shall also pay to the States the amount of any other expense which the States may incur or be liable for, and the amount of any payment which the States may be required to make, and the amount of any loss or damage which the States may incur or suffer, by reason of any neglect, fault or default of the Contractor. Or

(3) The Commissions may require the surety or sureties to perform and complete the Works or such part

REMEDIES IN CASE OF CONTRACTOR'S DEFAULT.

thereof as the Commissions may require, under the terms of this contract. Or

(4) The States may also proceed as to the Commissions shall seem proper upon the bonds or other security in its possession. And

(5) The States may also bring any suit or proceeding for specific performance or for injunction or to recover damages or to obtain any other relief or for any other purpose proper under this contract.

Engineer's
certificate
of expense.

ARTICLE LXIX.—In case the Commissions shall by contract or otherwise complete the Works or any part thereof under the provisions of Article LXVIII, the Engineer, upon the completion of the Works or such part thereof or at any time thereafter upon demand in writing by either party hereto or from time to time during the course of the completion of the Works or such part thereof upon demand by the Commissions, shall certify to the amount of the expense incurred by the States in the completion of the Works or such part thereof, and said certificate shall be final and conclusive and admissible in evidence against the Contractor in any litigation arising or growing out of this contract.

States may use
all remedies.

ARTICLE LXX.—The States may avail themselves of each and every remedy herein specifically given to the States or now or hereafter existing at law or in equity or by statute, and each and every such remedy shall be in addition to every other remedy so specifically given or otherwise so existing and may be exercised from time to time and as often and in such order as may be deemed expedient by the Commissions, and the exercise, or the beginning of the exercise, of one remedy shall not be

REMEDIES IN CASE OF CONTRACTOR'S DEFAULT.

deemed to be a waiver of the right to exercise, at the same time or thereafter, any other remedy, except that no two inconsistent remedies shall be exercised at the same time.

IN WITNESS WHEREOF, this contract^e has been executed by the New York State Bridge and Tunnel Commission, acting for and in behalf of the State of New York, in and by authority of a resolution duly adopted by the Commission, and these presents signed by the Chairman and attested by the Secretary, and by the New Jersey Interstate Bridge and Tunnel Commission, acting for and in behalf of the State of New Jersey, in and by authority of a resolution duly adopted by the Commission and these presents signed by the Chairman and attested by the Secretary, and the Contractor has * (hereunto set his hand and seal) (caused its corporate seal to be hereto affixed and these presents to be executed by its President and attested by its Secretary by virtue of a resolution duly adopted by its Board of Directors) the day and year first above written.

*If the Contractor is an individual, use the words enclosed in the first bracket; if a corporation, use the words enclosed in the second bracket.

TESTIMONIUM.

FOR THE STATE OF NEW YORK
NEW YORK STATE BRIDGE AND TUNNEL COMMISSION
By

.....
Chairman

Attest:

.....
Secretary

FOR THE STATE OF NEW JERSEY
NEW JERSEY INTERSTATE BRIDGE AND TUNNEL COMMISSION
By

.....
Chairman

Attest:

.....
Secretary

CONTRACTOR

..... (Seal)

(If corporation, name of corporation)

.....
President

Attest:

.....
Secretary,

ACKNOWLEDGMENTS.

State of New York, }
 County of New York, } ss.

On this day of , 1922, before me personally appeared George R. Dyer and Morris M. Frohlich, to me known and known to me to be the said George R. Dyer the Chairman and the said Morris M. Frohlich the Secretary of the New York State Bridge and Tunnel Commission; and the said George R. Dyer and Morris M. Frohlich being by me duly sworn did depose and say each for himself and not for the other; the said George R. Dyer that he resides in the Borough of Manhattan, in the City, County and State of New York; that he is Chairman of the said Commission and that he subscribed his name to the foregoing contract by virtue of the authority thereof; and the said Morris M. Frohlich that he resides in the Borough of Manhattan, in the City, County and State of New York; that he is the Secretary of the said Commission and that he subscribed his name thereto by like authority.

ACKNOWLEDGMENTS.

State of New York, }
 County of New York, } ss.

On this day of , 1922, before me personally appeared T. Albeus Adams and James P. Dolan, to me known and known to me to be, the said T. Albeus Adams, the Chairman and the said James P. Dolan, the Secretary of the New Jersey Interstate Bridge and Tunnel Commission; and the said T. Albeus Adams and James P. Dolan being by me duly sworn did depose and say each for himself and not for the other; the said T. Albeus Adams that he resides in the Town of Montclair, Essex County, New Jersey, that he is Chairman of the said Commission and that he subscribed his name to the foregoing contract by virtue of the authority thereof; and the said James P. Dolan that he resides in the City of Jersey City, Hudson County, New Jersey; that he is the Secretary of the said Commission and that he subscribed his name thereto by like authority.

.....

ACKNOWLEDGMENTS.

State of New York, }
 County of New York, } ss.

On this day of , 1922, before me
 personally came to me known and
 known to me to be the individual described in and who
 executed the foregoing instrument, and he duly acknowl-
 edged to me that he executed the same.

.....

State of New York, }
 County of New York, } ss.

On this day of , 1922, before me
 personally appeared
 to me known, who being by me first duly sworn did de-
 pose and say that he resides in in the State
 of , that he is the of
 , the corporation described in and which
 executed the foregoing instrument; that he affixed the
 corporate seal of said corporation; that one of the seals
 affixed to said contract is such corporate seal and that it
 was affixed thereto by order of the Board of Directors of
 said corporation and that he signed his name thereto by
 like order.

.....

FORM OF CONTRACTOR'S BOND.

FORM OF CONTRACTOR'S BOND.

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned,

as principal, and

as sureties, are hereby held and firmly bound unto the New York State Bridge and Tunnel Commission, acting for and in behalf of the State of New York, in the penal sum of one million dollars (\$1,000,000) for the payment of which well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this day of , 1922.
The condition of the above obligation is such that where-
as the above named principal did on the
day of , 1922, enter into a contract
with the New York State Bridge and Tunnel Commission,
acting for and in behalf of the State of New York, and
the New Jersey Interstate Bridge and Tunnel Commis-
sion, acting for and in behalf of the State of New Jersey,
which said contract is made a part of this bond the same
as though set forth herein:

FORM OF CONTRACTOR'S BOND.

Now, if the said

shall well and faithfully do and perform the things agreed by _____ to be done and performed according to the terms of said contract, and shall pay all lawful claims of sub-contractors, materialmen and laborers, for labor performed and materials furnished in the carrying forward, performing or completing of said contract, we agreeing and assenting that this undertaking shall be for the benefit of any materialman or laborer having a just claim, as well as for the obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety for value received hereby stipulates and agrees that any modifications, omissions, additions, or extensions of time in or to the said contract or in or to the plans and specifications therefor in no wise affect the obligations of said surety and its bond and it does hereby waive notice of any such modifications, omissions, additions and extensions.

IN WITNESS WHEREOF, the Contractor and the Sureties have hereunto set their hands and seals and such of them as are corporations have caused their respective seals to be hereto affixed and these presents to be attested by the proper officers this _____ day of _____, 1922.

FORM OF CONTRACTOR'S BOND.

(Affix Sureties' Acknowledgments and Justifications.)

FORM OF CONTRACTOR'S BOND.

FORM OF CONTRACTOR'S BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned,

as principal, and

as sureties, are hereby held and firmly bound unto the Chairman of the New Jersey Interstate Bridge and Tunnel Commission, acting for and in behalf of the State of New Jersey, in the penal sum of one million dollars (\$1,000,000), for the payment of which well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this day of , 1922.

The condition of the above obligation is such that whereas, the above named principal did on the day of , 1922, enter into a contract with the New Jersey Interstate Bridge and Tunnel Commission, acting for and in behalf of the State of New Jersey, and the New York State Bridge and Tunnel Commission, acting for and in behalf of the State of New York, which said contract is made a part of this bond the same as though set forth herein:

FORM OF CONTRACTOR'S BOND.

Now, if the said
shall well and faithfully do and perform the things agreed
by to be done and
performed according to the terms of said contract, and
shall pay all lawful claims of sub-contractors, material-
men and laborers, for labor performed and materials
furnished in the carrying forward, performing or com-
pleting of said contract, we agreeing and assenting that
this undertaking shall be for the benefit of any material-
man or laborer having a just claim, as well as for the
obligee herein; then this obligation shall be void; other-
wise the same shall remain in full force and effect, it
being expressly understood and agreed that the liability
of the surety for any and all claims hereunder shall in no
event exceed the penal amount of this obligation as here-
in stated.

The said surety for value received hereby stipulates
and agrees that any modifications, omissions, additions,
or extensions of time in or to the said contract or in or
to the plans and specifications therefor shall in no wise
affect the obligations of said surety and its bond and it
does hereby waive notice of any such modifications, omis-
sions, additions and extensions.

IN WITNESS WHEREOF, the Contractor and the Sureties
have hereunto set their hands and seals and such of them
as are corporations have caused their respective seals
to be hereto affixed and these presents to be attested by
the proper officers this
day of , 1922.

FORM OF CONTRACTOR'S BOND.

(Affix Sureties' Acknowledgments and Justifications.)

CONTRACTOR'S PROPOSAL.

(Form "A"—Made without dependence upon the award of any other contract)

FOR THE CONSTRUCTION OF THE NEW JERSEY RIVER
SECTION OF THE PROPOSED VEHICULAR TUNNEL.

To The New York State Bridge and Tunnel Commission,
acting for and in behalf of the State of New York,
and to the New Jersey Interstate Bridge and Tunnel
Commission, acting for and in behalf of the State
of New Jersey:

(1) The undersigned*

do hereby, in pursuance of the invitation and information for Contractors, copies of which are annexed hereto and made a part hereof, propose according to the terms thereof to enter into a contract in the form annexed hereto and made a part hereof with the State of New York and the State of New Jersey (hereinafter called the "States") acting by the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission (hereinafter called the "Commissions") for the construction of the New Jersey River section of the proposed Vehicular Tunnel and to furnish

*The bidder's name must be inserted here. If the bid is submitted by a corporation, the full legal title must be given here and a certified copy of the certificate of incorporation must be submitted, together with an affidavit showing the amount of stock paid in cash and the names and addresses of the directors and principal officers. If the bidder be a foreign corporation, proof must also be submitted of its authority to transact business in the State of New York and the State of New Jersey. If the bid is submitted by a partnership, the above blank must be filled up in the following form, "the firm of A. B. & Co., composed of A. B., C. D., etc." (giving the names of all the partners).

CONTRACTOR'S PROPOSAL—FORM "A."

all necessary labor, materials, plant, power, tools, equipment, supplies and other means of construction and perform all work mentioned in the said contract at the unit prices for the several items as given in the Schedule of Unit Prices. It is understood that the quantities of the various items specified in the following schedule are given only as a basis for the uniform comparison of bids and are not in any way guaranteed or represented as correct or intended to be relied upon and they shall not be taken as final and shall form no basis for any claim in case they do not correspond with the final measurements or quantities. It is further understood that the Commissions reserve the right to increase or diminish or to omit entirely any of the quantities of items.

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

*(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
		\$	c.		
	EXCAVATION.				
1.	For earth excavation, both above and below mean high water (except tunnel excavation and shaft excavation), includ- ing excavation for pipes, ducts and conduits, the sum of dollars and cents, per cubic yard			1,800	
4.	For shaft excavations in earth, above mean high water, the sum of dollars and cents, per cubic yard			350	
5.	For shaft excavation in earth, below mean high water, the sum of dollars and cents, per cubic yard			25,300	
6.	For shaft excavation in rock, the sum of dollars and cents, per cubic yard			10	

*If there are discrepancies between the prices expressed in writing and the prices expressed in figures, the prices expressed in writing will be taken as the bid prices.

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
8.	For tunnel excavation wholly in earth, the sum of	\$	c.		
	dollars				
	and cents,				
	per cubic yard			246,000	
9.	For tunnel excavation partly in earth and partly in rock, the sum of				
	dollars				
	and cents,				
	per cubic yard			9,500	
10.	For tunnel excavation wholly in rock, the sum of				
	dollars				
	and cents,				
	per cubic yard			10	
	SHIELD JUNCTIONS.				
16.	For furnishing and erecting junction bulkheads and locks, the lump sum of				
	dollars				
	and cents,				
	per bulkhead			2	
17.	For removing and disposing of junction bulkheads and locks, the lump sum of				
	dollars				
	and cents,				
	per bulkhead			2	

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
18. For dismantling and disposing of shields, the lump sum of dollars and cents, per shield		\$	c.		4
CONCRETE AND MASONRY.					
27. For concrete (except concrete placed in compressed air), as follows:					
(a) For concrete used in chang- ing sub-surface structures and concrete not otherwise provided for, the sum of dollars and cents, per cubic yard					50
(b) For shaft concrete (except concrete protection outside the steel of the river shaft caissons), the sum of dollars and cents, per cubic yard					9,500
(c) For concrete protection outside the steel of the river shaft caissons, the sum of dollars and cents, per cubic yard					750

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
	(d) For tunnel concrete, the sum of	\$	c.		
	dollars				
	and cents,				
	per cubic yard			50,300	
28.	For concrete placed in compressed air, as follows:				
	(b) For shaft concrete, the sum of				
	dollars				
	and cents,				
	per cubic yard			1,770	
	(d) For tunnel concrete, the sum of				
	dollars				
	and cents,				
	per cubic yard			110	
29.	For mortar batches used in connection with placing concrete, either in normal or compressed air, the sum of				
	dollars				
	and cents,				
	per barrel of cement used ..			2,000	

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices	Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
35. For granite facing on the outside of the river shaft caissons, the sum of	dollars	\$	c.	175
and per cubic yard	cents,			
36. For granite curbing in the tunnels, the sum of	dollars			19,250
and per lineal foot	cents,			
GROUT.				
45. For 1 to 1 Portland cement grout, not placed in compressed air, the sum of	dollars			100
and per barrel of cement used ..	cents,			
46. For 1 to 0 Portland cement grout (neat grout), not placed in compressed air, the sum of	dollars			100
and per barrel of cement used ..	cents,			

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
47.	For 1 to 1 Portland cement grout, placed in compressed air, the sum of dollars and cents, per barrel of cement used . .	\$	c.	200	
48.	For 1 to 0 Portland cement grout (neat grout), placed in compressed air, the sum of dollars and cents, per barrel of cement used . .			100	
49.	For 1 to 1 mixed cement grout, placed in compressed air, as follows: (a) For Portland cement used in mixed cement grout, the sum of dollars and cents, per barrel of Portland cement used (b) For natural cement used in mixed cement grout, the sum of dollars and cents, per barrel of natural cement used			10,000	
				20,000	

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

[illegible]

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
		\$	c.		
	(c) For twenty-four (24) inch piles, the sum of dollars and cents, per lineal foot			4,000	
57.	For platform required to be left around the river shafts, the sum of dollars and cents, per square foot			15,300	
59.	For timber bulkheads in the land shafts, the sum of dollars and cents, per thousand (1,000) feet, board measure			11	
	WATERPROOFING.				
60.	For waterproofing, treated wo- ven fabric (except dry ply), not laid in compressed air, without protective layer of brick, as follows:				
	(a) For one (1) ply, the sum of dollars and cents, per square yard			10	

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
		\$	c.		
	(b) For two (2) ply, the sum of dollars and cents, per square yard			10	
	(c) For three (3) ply, the sum of dollars and cents, per square yard			100	
	(d) For four (4) ply, the sum of dollars and cents, per square yard			550	
	(f) For six (6) ply, the sum of dollars and cents, per square yard			10	
64.	For waterproofing, treated wo- ven fabric, laid in com- pressed air, including pro- tective layer of brick, as fol- lows:				
	(d) For four (4) ply, the sum of dollars and cents, per square yard			880	

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
	(f) For six (6) ply, the sum of dollars and cents, per square yard	\$	c.	10	
66.	For applying (but not furnishing) protective waterproof coating, as follows: (a) On the outside steel of the river shaft caissons, and on the steel water-stops of the land shaft caissons, the sum of dollars and cents, per square yard			3,430	
	STEEL AND WROUGHT IRON.				
70.	For built-up steelwork (except steelwork of the land and river shaft caissons) and steelwork not otherwise provided for, the sum of dollars and cents, per ton			60	

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
71.	For steelwork forming part of the completed work of the land and river shaft caissons (except steel rods and bars), the sum of dollars and cents, per ton			2,660	
72.	For steel beams and shapes, with or without connections (ex- cept steelwork of the land and river shaft caissons and special rolled floor beams for the tunnel roadway), the sum of dollars and cents, per ton			130	
73.	For steel rods and bars for re- inforcing concrete, the sum of dollars and cents, per ton			480	
74.	For wire mesh, the sum of dollars and cents, per ton			160	

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
75. For special steel structures, as follows: (a) For special rolled floor beams for the tunnel roadway, the sum of dollars and cents, per ton (b) For built-up floor beams for the tunnel roadway, the sum of dollars and cents, per ton (c) For steelwork in the connecting rings between the caissons and the tunnel lining, the sum of dollars and cents, per ton (d) For steelwork in the permanent tie-rod anchorages, the sum of dollars and cents, per ton		\$	c.		
				1,715	
				245	
				83	
				1,100	

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
		\$	c.		
76.	For high tensile steel, as follows:				
	(a) For tunnel bolts and nuts, including soft steel or wrought-iron washers, the sum of				
	dollars				
	and cents,				
	per ton			3,280	
	(b) For permanent tie-rods, in- cluding bolts, pins, turn- buckles and clevises (but not including anchorages), the sum of				
	dollars				
	and cents,				
	per ton			275	
77.	For copper steel, as follows:				
	(a) For plates, bolts, nuts and washers, the sum of				
	dollars				
	and cents,				
	per ton			165	
83.	For furnishing and placing lad- ders, hand bars and miscel- laneous wrought-iron fixtures (but not including pipe or pipe fittings), the sum of				
	dollars				
	and cents,				
	per pound			500	

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
84. For furnishing and placing wrought-iron or steel pipe in the tunnel, as follows: (a) For one (1) inch pipe, the sum of dollars and cents, per lineal foot (b) For one and one-half (1½) inch pipe, the sum of dollars and cents, per lineal foot (c) For two (2) inch pipe, the sum of dollars and cents, per lineal foot (d) For two and one-half (2½) inch pipe, the sum of dollars and cents, per lineal foot (e) For three (3) inch pipe, the sum of dollars and cents, per lineal foot		\$	c.		

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(f) For four (4) inch pipe, the sum of dollars and cents, per lineal foot			400	
85.	For furnishing and placing galvanized iron electric conduits in the tunnel, as follows:				
	(a) For three-quarter ($\frac{3}{4}$) inch conduits, the sum of dollars and cents, per lineal foot			1,200	
	(b) For one (1) inch conduits, the sum of dollars and cents, per lineal foot			18,200	
	(c) For one and one-quarter ($1\frac{1}{4}$) inch conduits, the sum of dollars and cents, per lineal foot			3,150	

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(d) For one and one-half (1½) inch conduits, the sum of dollars and cents, per lineal foot			1,550	
	(f) For three (3) inch conduits, the sum of dollars and cents, per lineal foot			200	
86.	For furnishing and placing miscellaneous galvanized iron fixtures, as follows:				
	(a) For outlet boxes in the tunnel, the sum of dollars and cents, each			200	
	(b) For pull boxes (4"x4"x3") in the tunnel, the sum of dollars and cents, each			120	
	(c) For pull boxes (6"x6"x4") in the tunnel, the sum of dollars and cents, each			1,200	

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(d) For sheet metal air flues complete, including fittings, the sum of				
	dollars				
	and cents,				
	each			1,430	
	(e) For curb guards, ladders, hand bars and miscellaneous fixtures, the sum of				
	dollars				
	and cents,				
	per pound			42,500	
88.	For cast steel, as follows:				
	(a) For tunnel lining, except pile segments, the sum of				
	dollars				
	and cents,				
	per ton			8,950	
	(b) For pile segments, the sum of				
	dollars				
	and cents,				
	per ton			360	
	CAST IRON.				
90.	For cast-iron tunnel lining, the sum of				
	dollars				
	and cents,				
	per ton			72,300	

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
		\$	c.		
91.	For furnishing new cast-iron hub and spigot pipe (straight pipe) required for sub-sur- face changes, the sum of dollars and cents, per ton			90	
92.	For furnishing new cast-iron hub and spigot pipe (special cast- ings) required for sub-sur- face changes, the sum of dollars and cents, per ton			4	
95.	For furnishing and placing mis- cellaneous cast-iron fixtures, as follows: (a) For new manhole and catch basin fixtures, gratings, drain covers and castings not otherwise provided for (not including pipe or pipe fit- tings), the sum of dollars and cents, per ton			23	

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices	Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
100.	For furnishing and placing cast-iron water or other tunnel service pipe, as follows:	\$	c.	
	(b) For six (6) inch pipe, the sum of			
	dollars			
	and cents,			
	per lineal foot			9,700
	(c) For eight (8) inch pipe, the sum of			
	dollars			
	and cents,			
	per lineal foot			50
	(d) For ten (10) inch pipe, the sum of			
	dollars			
	and cents,			
	per lineal foot			50
	(e) For twelve (12) inch pipe, the sum of			
	dollars			
	and cents,			
	per lineal foot			10

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
	NON-CORROSIVE METAL.	\$	c.		
107.	For furnishing and placing non-corrosive metal, the sum of dollars and cents, per pound			10,800	
	BRONZE.				
108.	For furnishing and placing bronze fixtures, as follows: (a) For bolts, wedges and hinges, the sum of dollars and cents, per pound			2,000	
	TUNNEL DUCTS.				
110.	For tunnel ducts, as follows: (a) For single way ducts, the sum of dollars and cents, per duct foot			75,000	
	(b) For two (2) way ducts, the sum of dollars and cents, per duct foot			100	

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures).

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
		\$	c.		
	(c) For three (3) way ducts, the sum of dollars and cents, per duct foot			28,100	
	(d) For four (4) way ducts, the sum of dollars and cents, per duct foot			37,500	
	(e) For six (6) way ducts, the sum of dollars and cents, per duct foot			225,000	
	ASBESTOS MATERIALS.				
112.	For furnishing and placing as- bestos materials and com- pounds, as follows:				
	(a) For one-quarter ($\frac{1}{4}$) inch asbestos lumber, the sum of dollars and cents, per square foot			3,100	

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices	Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
SUB-SURFACE WATER PIPE CHANGES.		\$ c.		
120. For changing cast-iron water pipe (but not furnishing new pipe required), as follows:				
(b) For six (6) inch pipe, the sum of				
dollars				
and cents,				
per lineal foot			400	
(c) For eight (8) inch pipe, the sum of				
dollars				
and cents,				
per lineal foot			300	
(d) For ten (10) inch pipe, the sum of				
dollars				
and cents,				
per lineal foot			300	
(e) For twelve (12) inch pipe, the sum of				
dollars				
and cents,				
per lineal foot			50	

THE CONTRACTOR'S PROPOSAL—FORM "A"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices	Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
	NEW SUB-SURFACE GAS PIPE AND WATER PIPE LINES.	\$ c.		
123.	For laying cast-iron water pipe where required (but not furnishing new pipe), as follows:			
	(b) For six (6) inch pipe, the sum of			
	dollars			
	and cents,			
	per lineal foot		2,100	
	(c) For eight (8) inch pipe, the sum of			
	dollars			
	and cents,			
	per lineal foot		50	
	(d) For ten (10) inch pipe, the sum of			
	dollars			
	and cents,			
	per lineal foot		50	
124.	For laying cast-iron gas pipe where required (but not furnishing new pipe), as follows:			

THE CONTRACTOR'S PROPOSAL—FORM "A"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) <u>Amount</u>
		\$	c.		
	(a) For four (4) inch pipe, the sum of dollars and cents, per lineal foot			2,100	
	ENGINEER'S FIELD OFFICE.				
148.	For building and equipping an Engineer's field office, the lump sum of dollars and cents,			1	
	FENCING.				
155.	For building tight board fence, the sum of dollars and cents, per lineal foot of fence built			2,650	

CONTRACTOR'S PROPOSAL.

(Form "B"—Made dependent upon the same Contractor also being awarded Contract No. 3 of the Hudson River Vehicular Tunnel)

FOR THE CONSTRUCTION OF THE NEW JERSEY RIVER SECTION OF THE PROPOSED VEHICULAR TUNNEL.

To the New York State Bridge and Tunnel Commission, acting for and in behalf of the State of New York, and to the New Jersey Interstate Bridge and Tunnel Commission, acting for and in behalf of the State of New Jersey:

(1) The undersigned*

do hereby, in pursuance of the invitation and information for Contractors, copies of which are annexed hereto and made a part hereof, propose according to the terms thereof to enter into a contract in the form annexed hereto and made a part hereof with the State of New York and the State of New Jersey (hereinafter called the "States") acting by the New York State Bridge and Tunnel Com-

NOTE: This proposal, "Form "B," must be accompanied by a proposal in the form designated Form "B" of Contract No. 3 of the Hudson River Vehicular Tunnel.

*The bidder's name must be inserted here. If the bid is submitted by a corporation, the full legal title must be given here and a certified copy of the certificate of incorporation must be submitted, together with an affidavit showing the amount of stock paid in cash and the names and addresses of the directors and principal officers. If the bidder be a foreign corporation, proof must also be submitted of its authority to transact business in the State of New York and the State of New Jersey. If the bid is submitted by a partnership, the above blank must be filled up in the following form, "the firm of A. B. & C., composed of A. B., C. D., etc." (giving the names of all the partners).

mission and the New Jersey Interstate Bridge and Tunnel Commission (hereinafter called the "Commissions") for the construction of the New Jersey River Section of the proposed Vehicular Tunnel and to furnish all necessary labor, materials, plant, power, tools, equipment, supplies and other means of construction and perform all work mentioned in the said contract at the unit prices for the several items as given in the Schedule of Unit Prices; but this Proposal is submitted upon the express condition, that unless the Commissions shall also accept the proposal, submitted concurrently herewith by the undersigned, for the construction of Contract No. 3, being the New York River Section of the Hudson River Vehicular Tunnel, in the form designated Form "B", the obligation of the undersigned under this proposal shall cease. It is understood that the quantities of the various items specified in the following schedule are given only as a basis for the uniform comparison of bids and are not in any way guaranteed or represented as correct or intended to be relied upon and they shall not be taken as final and shall form no basis for any claim in case they do not correspond with the final measurements or quantities. It is further understood that the Commissions reserve the right to increase or diminish or to omit entirely any of the quantities of items.

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

*(Bid prices are to be filled out both in writing and in figures.)

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
	EXCAVATION.	\$	c.		
1.	For earth excavation, both above and below mean high water, (except tunnel excavation and shaft excavation), in- cluding excavation for pipes, ducts and conduits, the sum of dollars and cents, per cubic yard			1,800	
4.	For shaft excavation in earth, above mean high water, the sum of dollars and cents, per cubic yard			350	
5.	For shaft excavation in earth, be- low mean high water, the sum of dollars and cents, per cubic yard			25,300	
6.	For shaft excavation in rock, the sum of dollars and cents, per cubic yard			10	

*If there are discrepancies between the prices expressed in writing and the prices expressed in figures, the prices expressed in writing will be taken as the bid prices.

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
		\$	c.		
8. For tunnel excavation wholly in earth, the sum of					
	dollars				
	and cents,				
	per cubic yard			246,000	
9. For tunnel excavation partly in earth and partly in rock, the sum of					
	dollars				
	and cents,				
	per cubic yard			9,500	
10. For tunnel excavation wholly in rock, the sum of					
	dollars				
	and cents,				
	per cubic yard			10	
CONCRETE AND MASONRY.					
27. For concrete (except concrete placed in compressed air), as follows:					
(a) For concrete used in chang- ing sub-surface structures and concrete not otherwise pro- vided for, the sum of					
	dollars				
	and cents,				
	per cubic yard			50	

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(b) For shaft concrete (except concrete protection outside the steel of the river shaft caissons), the sum of dollars and cents, per cubic yard			9,500	
	(c) For concrete protection outside the steel of the river shaft caissons, the sum of dollars and cents, per cubic yard			750	
	(d) For tunnel concrete, the sum of dollars and cents, per cubic yard			50,300	
28.	For concrete placed in compressed air, as follows: (b) For shaft concrete, the sum of dollars and cents, per cubic yard			1,770	

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
	(d) For tunnel concrete, the sum of	\$	c.		
	dollars				
	and cents,				
	per cubic yard			110	
29.	For mortar batches used in connection with placing concrete, either in normal or compressed air, the sum of				
	dollars				
	and cents,				
	per barrel of cement used ..			2,000	
35.	For granite facing on the outside of the river shaft caissons, the sum of				
	dollars				
	and cents,				
	per cubic yard			175	
36.	For granite curbing in the tunnels, the sum of				
	dollars				
	and cents,				
	per lineal foot			19,250	

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
	GROUT.	\$	c.		
45.	For 1 to 1 Portland cement grout, not placed in compressed air, the sum of dollars and cents, per barrel of cement used . .			100	
46.	For 1 to 0 Portland cement grout (neat grout), not placed in compressed air, the sum of dollars and cents, per barrel of cement used . .			100	
47.	For 1 to 1 Portland cement grout, placed in compressed air, the sum of dollars and cents, per barrel of cement used . .			200	
48.	For 1 to 0 Portland cement grout (neat grout), placed in com- pressed air, the sum of dollars and cents, per barrel of cement used . .			100	
49.	For 1 to 1 mixed cement grout placed in compressed air, as follows:				

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices	Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$ c.		
	(a) For Portland cement used in mixed cement grout, the sum of dollars and cents, per barrel of Portland ce- ment used		10,000	
	(b) For natural cement used in mixed cement grout, the sum of dollars and cents, per barrel of natural cement used		20,000	
50.	For 1 to 0 mixed cement grout (neat grout) placed in com- pressed air, as follows:			
	(a) For Portland cement used in mixed cement grout, the sum of dollars and cents, per barrel of Portland cement used		100	

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(b) For natural cement used in mixed cement grout, the sum of dollars and cents, per barrel of natural cement used				250
	PILING AND TIMBERING.				
54.	For reinforced concrete piles to support the river shaft caissons in final position, as follows: (b) For twenty (20) inch piles, the sum of dollars and cents, per lineal foot				9,000
	(c) For twenty-four (24) inch piles, the sum of dollars and cents, per lineal foot				4,000
57.	For platform required to be left around the river shafts, the sum of dollars and cents, per square foot				15,300

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices	Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
59.	For timber bulkheads in the land shafts, the sum of dollars and cents, per thousand (1,000) feet, board measure	\$ c.	11	
	WATERPROOFING.			
60.	For waterproofing, treated wo- ven fabric (except dry ply), not laid in compressed air, without protective layer of brick, as follows:			
	(a) For one (1) ply, the sum of dollars and cents, per square yard		10	
	(b) For two (2) ply, the sum of dollars and cents, per square yard		10	
	(c) For three (3) ply, the sum of dollars and cents, per square yard		100	

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(d) For four (4) ply, the sum of dollars and cents, per square yard			550	
	(f) For six (6) ply, the sum of dollars and cents, per square yard			10	
64.	For waterproofing, treated woven fabric, laid in compressed air, including protective layer of brick, as follows:				
	(d) For four (4) ply, the sum of dollars and cents, per square yard			880	
	(f) For six (6) ply, the sum of dollars and cents, per square yard			10	
66.	For applying (but not furnishing) protective waterproof coating, as follows:				

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
	(a) On the outside steel of the river shaft caissons, and on the steel water-stops of the land shaft caissons, the sum of dollars and cents, per square yard	\$	c.		3,430
	STEEL AND WROUGHT IRON.				
70.	For built-up steelwork (except steelwork of the land and river shaft caissons) and steelwork not otherwise pro- vided for, the sum of dollars and cents, per ton				60
71.	For steelwork forming part of the completed work of the land and river shaft caissons (ex- cept steel rods and bars) the sum of dollars and cents, per ton				2,660

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
72.	For steel beams and shapes, with or without connections (except steelwork of the land and river shaft caissons and special rolled floor beams for the tunnel roadway), the sum of dollars and cents, per ton			130	
73.	For steel rods and bars for re- inforcing concrete, the sum of dollars and cents, per ton			480	
74.	For wire mesh, the sum of dollars and cents, per ton			160	
75.	For special steel structures, as follows: (a) For special rolled floor beams for the tunnel road- way, the sum of dollars and cents, per ton			1,715	

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(b) For built-up floor beams for the tunnel roadway, the sum of dollars and cents, per ton			245	
	(c) For steelwork in the con- necting rings between the caissons and the tunnel lin- ing, the sum of dollars and cents, per ton			83	
	(d) For steelwork in the per- manent tie-rod anchorages, the sum of dollars and cents, per ton			1,100	
76. For high tensile steel, as follows:					
	(a) For tunnel bolts and nuts, including soft steel or wrought-iron washers, the sum of dollars and cents, per ton			3,280	

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
	(b) For permanent tie-rods, including bolts, pins, turn-buckles and clevises (but not including anchorages), the sum of dollars and cents, per ton	\$	c.		275
77.	For copper steel, as follows: (a) For plates, bolts, nuts and washers, the sum of dollars and cents, per ton				165
83.	For furnishing and placing ladders, hand bars and miscellaneous wrought-iron fixtures (but not including pipe or pipe fittings), the sum of dollars and cents, per pound				500
84.	For furnishing and placing wrought-iron or steel pipe in the tunnel, as follows: (a) For one (1) inch pipe, the sum of dollars and cents, per lineal foot				100

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(b) For one and one-half (1½) inch pipe, the sum of dollars and cents, per lineal foot			400	
	(c) For two (2) inch pipe, the sum of dollars and cents, per lineal foot			100	
	(d) For two and one-half (2½) inch pipe, the sum of dollars and cents, per lineal foot			100	
	(e) For three (3) inch pipe, the sum of dollars and cents, per lineal foot			100	
	(f) For four (4) inch pipe, the sum of dollars and cents, per lineal foot			400	
85.	For furnishing and placing galvanized iron electric conduits in the tunnel, as follows:				

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(a) For three-quarter ($\frac{3}{4}$) inch conduits, the sum of dollars and cents, per lineal foot			1,200	
	(b) For one (1) inch conduits, the sum of dollars and cents, per lineal foot			18,200	
	(c) For one and one-quarter ($1\frac{1}{4}$) inch conduits, the sum of dollars and cents, per lineal foot			3,150	
	(d) For one and one-half ($1\frac{1}{2}$) inch conduits, the sum of dollars and cents, per lineal foot			1,550	
	(f) For three (3) inch conduits, the sum of dollars and cents, per lineal foot			200	
86.	For furnishing and placing mis- cellaneous galvanized iron fixtures, as follows:				

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(a) For outlet boxes in the tunnel, the sum of				
	dollars				
	and cents,				
	each			200	
	(b) For pull boxes (4"x4"x3") in the tunnel, the sum of				
	dollars				
	and cents,				
	each			120	
	(c) For pull boxes (6"x6"x4") in the tunnel, the sum of				
	dollars				
	and cents,				
	each			1,200	
	(d) For sheet metal air flues complete, including fittings, the sum of				
	dollars				
	and cents,				
	each			1,430	
	(e) For curb guards, ladders, hand bars and miscellaneous fixtures, the sum of				
	dollars				
	and cents,				
	per pound			42,500	

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
88.	For cast steel, as follows: (a) For tunnel lining, except pile segments, the sum of dollars and cents, per ton (b) For pile segments, the sum of dollars and cents, per ton			8,950	
	CAST IRON.				
90.	For cast-iron tunnel lining, the sum of dollars and cents, per ton			72,300	
91.	For furnishing new cast-iron hub and spigot pipe (straight pipe) required for sub-sur- face changes, the sum of dollars and cents, per ton			90	

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
92.	For furnishing new cast-iron hub and spigot pipe (special cast- ings) required for sub-sur- face changes, the sum of dollars and cents, per ton	\$	c.	4	
95.	For furnishing and placing mis- cellaneous cast-iron fixtures, as follows: (a) For new manhole and catch basin fixtures, gratings, drain covers and castings not other- wise provided for (not in- cluding pipe or pipe fittings), the sum of dollars and cents, per ton			23	
100.	For furnishing and placing cast-iron water or other tun- nel service pipe, as follows: (b) For six (6) inch pipe, the sum of dollars and cents, per lineal foot			9,700	

THE CONTRACTOR'S PROPOSAL—FORM "B"

SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approx- imate Quantities	(This col- umn not to be used by bidder.) Amount
		\$	c.		
	(c) For eight (8) inch pipe, the sum of dollars and cents, per lineal foot			50	
	(d) For ten (10) inch pipe, the sum of dollars and cents, per lineal foot			50	
	(e) For twelve (12) inch pipe, the sum of dollars and cents, per lineal foot			10	
	NON-CORROSIVE METAL.				
107.	For furnishing and placing non- corrosive metal, the sum of dollars and cents, per pound			10,800	
	BRONZE.				
108.	For furnishing and placing bronze fixtures, as follows:				
	(a) For bolts, wedges and hinges, the sum of dollars and cents, per pound			2,000	

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
	TUNNEL DUCTS.	\$	c.		
110.	For tunnel ducts, as follows:				
	(a) For single way ducts, the sum of				
	dollars				
	and cents,				
	per duct foot			75,000	
	(b) For two (2) way ducts, the sum of				
	dollars				
	and cents,				
	per duct foot			100	
	(c) For three (3) way ducts, the sum of				
	dollars				
	and cents,				
	per duct foot			28,100	
	(d) For four (4) way ducts, the sum of				
	dollars				
	and cents,				
	per duct foot			37,500	
	(e) For six (6) way ducts, the sum of				
	dollars				
	and cents,				
	per duct foot			225,000	

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
	ASBESTOS MATERIALS.	\$	c.		
112.	For furnishing and placing asbestos materials and compounds, as follows:				
	(a) For one-quarter ($\frac{1}{4}$) inch asbestos lumber, the sum of				
	dollars				
	and cents,				
	per square foot				3,100
	SUB-SURFACE WATER PIPE CHANGES.				
120.	For changing cast-iron water pipe (but not furnishing new pipe required), as follows:				
	(b) For six (6) inch pipe, the sum of				
	dollars				
	and cents,				
	per lineal foot				400
	(c) For eight (8) inch pipe, the sum of				
	dollars				
	and cents,				
	per lineal foot				300
	(d) For ten (10) inch pipe, the sum of				
	dollars				
	and cents,				
	per lineal foot				300

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
		\$	c.		
	(e) For twelve (12) inch pipe, the sum of dollars and cents, per lineal foot			50	
	NEW SUB-SURFACE GAS PIPE AND WATER PIPE LINES.				
123.	For laying cast-iron water pipe where required (but not furnishing new pipe), as follows:				
	(b) For six (6) inch pipe, the sum of dollars and cents, per lineal foot			2,100	
	(c) For eight (8) inch pipe, the sum of dollars and cents, per lineal foot			50	
	(d) For ten (10) inch pipe, the sum of dollars and cents, per lineal foot			50	

THE CONTRACTOR'S PROPOSAL—FORM "B"
SCHEDULE.

(Bid prices are to be filled out both in writing and in figures)

Item	Classification	Prices		Engineer's Estimated Approximate Quantities	(This column not to be used by bidder.) Amount
124. For laying cast-iron gas pipe where required (but not furnishing new pipe), as follows: (a) For four (4) inch pipe, the sum of dollars and cents, per lineal foot		\$	c.		2,100
ENGINEER'S FIELD OFFICE. 148. For building and equipping an Engineer's field office, the lump sum of dollars and cents,					1
FENCING. 155. For building tight board fence, the sum of dollars and cents, per lineal foot of fence built.					2,650

CONTRACTOR'S PROPOSAL.

(2) If this proposal is accepted, the undersigned will within five (5) days after the delivery of notice attend at the office of the Commissions in person or by duly authorized representatives, and will then and there deliver the contract with the States in the form aforesaid duly executed, and with its execution duly proved; and the undersigned will at the same time deliver to the Commissions pursuant to the terms of said contract *bonds in the sum total of two million dollars (\$2,000,000), in the forms annexed hereto and made a part hereof, with the following named sureties, or, in the event that the following named sureties or any of them shall not be approved by the Commissions with such other sureties as the Commissions shall approve.*

It is understood that the acceptance of this proposal by the Commissions shall not be construed as an approval of the sureties named in this proposal and in case the sureties named in this proposal are not approved by the Commissions, the undersigned, within five (5) days after notice of disapproval or within such further period, if any, as may be prescribed by the Commissions, shall substitute the names of other sureties approved by the Commissions.

CONTRACTOR'S PROPOSAL.

(3) If the Commissions shall notify the undersigned that this proposal is accepted, then if the undersigned shall fail within five (5) days thereafter or within such further period, if any, as may be prescribed by the Commissions to execute and deliver the contract or execute and deliver the said bonds, the undersigned may, at the option of the Commissions be deemed either to have made the contract or to have abandoned the contract. And in the latter case the Commissions may give notice thereof to the undersigned and may thereupon proceed to make another contract with such, if any, of the original bidders as in the opinion of the Commissions it will be to the best interest of the States to contract with or may, with or without public advertisement, invite further proposals and the undersigned shall thereupon be liable to the States for all loss and damage sustained by the States by reason of such failure of the undersigned. Inasmuch as the amount of such loss and damage will be extremely difficult to ascertain, especially in view of the fact that the construction of the Tunnel is a part of the construction of the Vehicular Tunnel and that any delay in the construction of said Tunnel may delay the construction and completion of said Vehicular Tunnel, it is expressly understood and agreed that such loss and damage shall be liquidated and paid as follows: The undersigned shall pay to the States the expense of such new advertisement, if any, and in addition thereto the sum of one thousand dollars (\$1,000) for each and every day, except Sundays and legal holidays, that the States shall be delayed in entering into a contract for the making of said Tunnel by reason of such failure of the undersigned, and in addition thereto the excess, if any, of the amount of the bid, calculated from the quantities and prices contained in the proposal, which the States shall accept and upon which they shall enter

CONTRACTOR'S PROPOSAL.

into a contract for the construction of such Tunnel over the amount of the bid calculated from the quantities and prices contained in this proposal of the undersigned; which sums are hereby agreed upon not as a penalty but as liquidated damages which the States will suffer by reason of such failure of the undersigned. And the invitation and information for contractors and this proposal shall constitute a contract binding the undersigned to pay to the States the loss and damage sustained by the States by reason of such failure of the undersigned as aforesaid.

(4) At the time of the delivery of this proposal to the Commissions the undersigned will separately deliver two certified checks for the sum of one hundred fifty thousand dollars (\$150,000) each, one payable to the order of the Comptroller of the State of New York and one payable to the order of the Chairman of the New Jersey Interstate Bridge and Tunnel Commission. And the undersigned hereby assigns to the States the said sums so especially deposited by the delivery of such certified checks as security for the performance of the obligations of the undersigned under this proposal. It is understood that said checks are to be returned to the undersigned when the contract for the construction of such Tunnel is executed and complied with, unless all the proposals submitted in response to said invitation and information for contractors shall be rejected by the Commissions and in that case when such proposals are rejected, as provided in the invitation and information for contractors. In case the undersigned shall default in the performance of any of the obligations of the undersigned under this proposal, the States shall have the right to apply the amount so especially deposited or so much thereof as may be necessary as a payment on account of the damages sus-

CONTRACTOR'S PROPOSAL.

tained by the States by reason of such default as aforesaid and shall return the balance, if any, to the undersigned. If the amount of such damages shall exceed the amount of said sums so especially deposited, the undersigned shall promptly upon demand from the Commissions pay the amount of such excess to the States.

(5) A notice that this proposal has been accepted addressed to the undersigned by the Commissions as aforesaid shall forthwith, at the option of the Commissions, operate as against the undersigned as a complete making of a contract according to the form thereof as aforesaid, with the blanks therein contained filled in according to this proposal.

(6) The Commissions may cause any notice intended for the undersigned to be delivered at Room No. on the floor of the building No. in the Borough of in the City of New York, or Room No. on the floor of Building No. in the City of N. J. Such delivery shall be sufficient notice to the undersigned.

(7) There are no persons interested with the undersigned in this proposal, except*

(8) This proposal is made without any connection with any other person making a proposal or bid for the

*Here insert the names and addresses of all persons interested with the bidder. If there are no such persons, strike out the word "except."

CONTRACTOR'S PROPOSAL.

same purpose and is in all respects fair and without collusion or fraud. No employee of the Commissions is interested directly or indirectly, as contracting party, partner, stockholder or otherwise in or in the performance of the contract or in the supplies, work or business to which it relates or in any portion of the profits thereof.

Dated,

, 1922.

County of New York, }
 State of New York, } ss.

being duly

sworn, says: I am*

the proposing contractor above named. I have read the foregoing proposal. The same is in all respects true.

*If the bidder be an individual do not fill in this blank; if the bidder be a partnership, insert "a member of the firm of _____"; if a corporation, insert, "the (President or other officer duly authorized) of the _____ Company."

SURETIES' CONSENT.

SURETIES' CONSENT.

That for and in consideration of the sum of one dollar (\$1.00), lawful money of the United States, the receipt whereof is hereby acknowledged, and as an inducement for and in consideration of the receipt and consideration of the bid annexed hereto and for other valuable considerations,

consent and agree, that, if the contract for which the preceding proposal is made, be awarded to

we will become jointly and severally bound as sureties for its faithful performance and will execute the bonds in the form annexed to this proposal in the sum of two million dollars (\$2,000,000), when so required, as herein provided:

And if the said

shall omit or refuse to execute such contract within five (5) days from the time when notified by the Commissions or if we refuse to execute such bonds within the same time, then, we will pay, without proof of notice on demand to the said Commissions, any difference between the amount of the foregoing proposal and the sum to which the person, persons or corporation, to whom the contract shall be finally awarded, would be entitled to receive upon such completion, the amount of said difference to be calculated upon the estimated amount of work by which the bids are tested, plus the expenses of re-advertising, if any, and a sum of one thousand dollars (\$1,000) per

SURETIES' CONSENT.

day for each and every day, except Sundays and legal holidays, that the States shall be delayed in entering into a Contract for the construction of the said Tunnel, as liquidated damages:

If we refuse to execute such bonds as aforesaid, then, the Commissions shall at their election, have the right to pursue any remedy at law or in equity, including an action for specific performance to compel the execution of such bond.

IN WITNESS WHEREOF, the undersigned have signed this agreement (or the undersigned corporations have caused this agreement to be signed by their proper officials and their corporate seals to be hereto affixed) this day of , 1922.

SURETIES' CONSENT.

Attach acknowledgments and statements of surety
companies here.

SURETIES' CONSENT.

State of }
 County of } ss.

On this day of
 1922, before me personally came

.....

.....

.....

.....

to me known and known to me to be the same person
 described in and who executed the foregoing consent,
 and acknowledged to me that
 executed the same for the purpose therein mentioned.

.....

.....

(Title)

SURETIES' CONSENT.

Note.—If the sureties are householders, the word “house” must be written in the following directions; if freeholders, the word “free” must be written. Each of these depositions must be signed by one of the proposed bondsmen and sworn to.

Additional blanks, if needed, will be furnished upon application to the Secretary.

County of }
State of } ss.

The above-named
being duly sworn, says that he is a holder in
.....;
that he resides at
.....;
and is worth the sum of
..... dollars (\$.....),
being the amount of security required for
the completion of the contract above referred to, over and
above all his debts of every nature, over and above his
liabilities as bail, surety, or otherwise, and over and
above all his property which is exempt by law from exe-
cution; and that he has offered himself as a surety in
good faith, and with an intention to execute the bond
required by law.

.....
The following is a complete statement of all the de-
ponent's assets and liabilities:

STATEMENT OF ASSETS AND LIABILITIES.

Subscribed and sworn to before me, this

..... day of, 1922

.....

.....

(Title)

SURETIES' CONSENT.

Note.—If the sureties are householders, the word “house” must be written in the following directions; if freeholders, the word “free” must be written. Each of these depositions must be signed by one of the proposed bondsmen and sworn to.

Additional blanks, if needed, will be furnished upon application to the Secretary.

County of _____ }
State of _____ } ss.

The above-named _____
being duly sworn, says that he is a _____ holder in

that he resides at _____

and is worth the sum of _____
_____ dollars (\$_____),
being _____ the amount of security required for
the completion of the contract above referred to, over and
above all his debts of every nature, over and above his
liabilities as bail, surety, or otherwise, and over and
above all his property which is exempt by law from exe-
cution; and that he has offered himself as a surety in
good faith, and with an intention to execute the bond
required by law.

The following is a complete statement of all the de-
ponent's assets and liabilities:

STATEMENT OF ASSETS AND LIABILITIES.

Subscribed and sworn to before me, this

_____ day of _____, 1922

(Title)

SURETIES' CONSENT.

Note.—If the sureties are householders, the word “house” must be written in the following directions; if freeholders, the word “free” must be written. Each of these depositions must be signed by one of the proposed bondsmen and sworn to.

Additional blanks, if needed, will be furnished upon application to the Secretary.

County of }
State of } ss.:

The above-named
being duly sworn, says that he is aholder in
.....;
that he resides at
.....;
and is worth the sum of
..... dollars (\$.....),
being the amount of security required for
the completion of the contract above referred to, over and
above all his debts of every nature, over and above his
liabilities as bail, surety, or otherwise, and over and
above all his property which is exempt by law from exe-
cution; and that he has offered himself as a surety in
good faith, and with an intention to execute the bond
required by law.

The following is a complete statement of all the de-
ponent's assets and liabilities:

STATEMENT OF ASSETS AND LIABILITIES.

Subscribed and sworn to before me, this

..... day of, 1922

.....

.....

(Title)

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